SYMPOSIUM ON

FISH AND WILDLIFE MANAGEMENT IN ALBERTA: CURRENT PRACTICE - FUTURE STRATEGIES

Co-sponsored by

THE ALBERTA SOCIETY OF PROFESSIONAL BIOLOGISTS

and

FISH AND WILDLIFE DIVISION
ALBERTA ENERGY AND NATURAL RESOURCES

Westin Hotel
Edmonton, Alberta
April 16 and 17, 1985

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ACKNOWLEDGEMENTS

This Symposium was held at the Westin Hotel in Edmonton, April 16 and 17, 1984. The Symposium was co-sponsored by the Fish and Wildlife Division of Alberta Energy and Natural Resources, which provided a substantial grant to assist with the financial costs associated with the Symposium..

The proceedings were chaired by Stewart Smith, Chairman of the 1984 Symposium Committee. Members of the 1985 Symposium Committee were:

S.B. Smith (Program Chairman and Symposium Editor)
Judith A. Smith
J.E. Green (Registrar and Co-Editor)
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D.L. Dabbs (Display Books)

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Corporate donations have substantially assisted the Society in extending its activities and services to its members in a manner which otherwise would not be possible without such support.

To all others not mentioned here, including Symposium speakers and participants, who helped in many ways, thanks are extended by the Alberta Society of Professional Biologists.

Message From The President, Alberta Society of Professional Biologists

This is the Ninth Annual Symposium sponsored by the Alberta Society of Professional Biologists. As the title indicates, the Symposium topic was provincial in scope; it was intended to provide a review of current fish and wildlife management practices in Alberta and an insight into future strategies that are developing for resource use. With the increased demands on fish and wildlife resources in the province and the alterations of current management policies (i.e., the New Alberta Wildlife Act and the New East Slope Policy), user groups and planners are concerned with future resource management. The Symposium was appropriately co-sponsored by the Fish and Wildlife Division of Alberta Energy and Natural Resources.

There were a broad diversity of presentation formats as well as topics at the Symposium. Representatives from government, industry and the public, as the managers and the user groups of these resources in the province, presented their perceptions on fish and wildlife resources. The panel discussion was designed to allow the diverse opinions of the public sector to be aired. A new format this year was the half-day concurrent technical workshops that dealt with the practical aspects of evaluating and improving fisheries and wildlife resources and habitats.

We hope that the participants found the Symposium well-balanced and interesting in its topics, viewpoints and structure, that they gleaned some insights into the practical as well as the administrative aspects of fish and wildlife resource management, and attained a better understanding of the benefits and deficiencies of current management practices and its future prospects in Alberta.

The 1985 Symposium Committee of the Alberta Society of Professional Biologists wishes to express its sincere thanks to the speakers and participants for their support, as well to the groups providing financial contributions; without their assistance the Symposium could not have been presented.

Judith Smith

Judith A. Smith
President
Alberta Society of Professional Biologists

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS	i
PREFACE	iv
OPENING ADDRESS	
- Mr. F.W. McDougall, Deputy Minister of Renewable Resources, Alberta Energy and Natural Resources	1
KEYNOTE ADDRESS	
- Mr. Robert C. Fields, Manager, Klamath Basin National Refuges, Tulelake, California	5
FISH AND WILDLIFE MANAGEMENT OBJECTIVES	
- Mr. D.C. Surrendi, Assistant Deputy Minister, Fish and Wildlife Division, Alberta Energy and Natural Resources	27
STATUS OF "CURRENT AND FUTURES USES OF FISH AND WILDLIFE RESOURCES"	
- Dr. Paul Paetkau, Research Unit Supervisor, Fish and Wildlife Division, Alberta Energy and Natural Resources	38
LUNCHEON ADDRESS: THE ANIMAL RIGHTS MOVEMENT - IMPLICATIONS FOR WILDLIFE MANAGEMENT	
- Alan Herscovici Author, Outremont, Quebec	45
PANEL DISCUSSION - PUBLIC PERCEPTIONS OF FISH AND WILDLIFE MANAGEMENT IN ALBERTA	
Chairman: Dr. D.A. Birdsall, LGL Limited	53
Participants:	
Sam Sinclair - Metis Association of Alberta	
Ron Gladish - Alberta Fish and Game Association	
Gerald Labrie - Alberta Trappers Association	
Vivian Pharis - Alberta Wilderness Association	
Neil Jennings - Trout Unlimited	
Lorraine Atkinson - A Citizen's Point of View	
Fish and Wildlife Division Respondents:	
Tom Mill - Fisheries	
Ken Ambrock - Habitat	
Bill Hall - Wildlife	

Page

MANAGEMENT TECHNIQUES WORKSHOP

FISHERIES MANAGEMENT TECHNIQUES

- Chairman: C.E. Stenton, Fish & Wildlife Division ... 86

IN-STREAM FLOW EVALUATION

- Brian Bietz, IEC Beak Ltd., Calgary, Alberta 87

STREAM RECLAMATION

- Jim Allan, Pisces Environmental Consulting Services Ltd., Red Deer, Alberta 95

PHYSICAL STREAM IMPROVEMENT

- Lorne Fitch, Fish and Wildlife Division, Lethbridge, Alberta 100

ARTIFICIAL PROPAGATION

- Mel Kraft, Fish and Wildlife Division, Rocky Mountain House, Alberta 109

BIOLOGICAL STREAM IMPROVEMENT

- Stuart B. Smith, S.B. Smith Environmental Consultants Limited 116

WILDLIFE MANAGEMENT TECHNIQUES

- Chairman: S.E. Stephansson, Canstar Ltd. 145

HABITAT EVALUATION

- Ross Eccles, LGL Limited, Calgary, Alberta and Harry Stelfox, Fish and Wildlife Division, Edmonton, Alberta 146

LAND RECLAMATION FOR WILDLIFE

- Jeffrey E. Green, LGL Limited, Calgary, Alberta 160

POPULATION CENSUS

- Bill Hall, Fish and Wildlife Division, Edmonton, Alberta 180

Page

WILDLIFE MANAGEMENT TECHNIQUES (continued)

HARVEST EVALUATION

- Bill Wishart, Fish and Wildlife Division, Edmonton, Alberta 185

INTERCEPT FEEDING OF WILDLIFE

- Herb Goulden, Manitoba Department of Natural Resources 200

ROLES AND RESPONSIBILITIES OF PUBLIC AND INDUSTRY IN FISH AND WILDLIFE MANAGEMENT 210

FISH AND WILDLIFE CONSIDERATIONS IN PROJECT DEVELOPMENT

- Robert Webb, R. Webb Environmental Consultants Ltd., Richmond, B.C. 211

PUBLIC INVOLVEMENT IN FISH AND WILDLIFE MANAGEMENT
- Richard Roberts, Praxis 84, Calgary, Alberta 226

THE ROLE OF CANADIAN HUNTER IN THE DEEP BASIN OF ALBERTA

- David Bowman, Canadian Hunter Exploration Ltd., Calgary, Alberta 240

SYMPOSIUM SUMMARY

- Donald J. Robinson, Former Director, B.C. Fish and Wildlife Branch, Victoria, B.C. 251

LIST OF SYMPOSIUM REGISTRANTS 267

OPENING ADDRESS

MR. FRED W. McDOUGALL

DEPUTY MINISTER OF NATURAL RESOURCES

ALBERTA ENERGY AND NATURAL RESOURCES

Thank you. Good morning ladies and gentlemen and welcome on behalf of the Honorable Don Sparrow, Minister for Public Lands and Wildlife. I am very pleased to pass along to you his greetings and welcome. I understand there are a number of guests from out of the country and from other parts of Canada, and I wish especially to welcome you.

It is a pleasure for us to have co-sponsored this Symposium, the 9th Symposium that the Alberta Society of Professional Biologists have held. We are particularly pleased that the agenda and the topic for this year covers fish and wildlife management in Alberta specifically. There is a rich diversity of wildlife in this province and your topics cover a wide range of subject matter which provides ample opportunity for a good productive and wide-ranging discussion.

During the last three years under the leadership of our very active Minister we've seen more cabinet and legislative time spent on fish and wildlife matters than at any previous time in this province. Flowing from the fish and wildlife policy statement which was approved as a government policy just prior to the last election, we've seen in the last three years a discussion paper published on the new Wildlife Act, and the new Wildlife Act go through the legislature. We've seen a published Status Report on Fish and Wildlife Resources and in addition to those we've seen work proceeding at a fast pace on a new set of regulations under the Wildlife Act and on a series of individual policy statements with regard to outfitting, trapping, game ranching and commercial fishing.

The Fish and Wildlife Advisory Council has been revitalized with increased membership and is providing important advice on all

of these matters. The restructuring and restaffing of the division have resulted in a more effective action-oriented organization. Attitudes are changing from being critical and defensive to being doers and getting things done largely reflecting the attitude of our present Minister. More specifically in recent years we've seen the development of an excellent productive staff with outstanding credentials and abilities both at our branch director level in Edmonton and at our regional director level in the field. We've completed the development of our regional offices, made regionalization work as it was intended to work to greatly improve our operational effectiveness and provide for regional input and modifications to our programs. We have a more effective field management program and field enforcement program with improved policy direction to field enforcement personnel. We have much more effective input on Federal-Provincial matters, particularly in regard to the migratory bird seasons, and Alberta's interests are being better managed and better protected than they once were.

The completion of the finest pheasant hatchery in the country at Brooks has increased production to 100,000 birds annually. A debottlenecking of our fish hatchery system with the completion of the Aliceson Creek Brood Station has overcome cronic shortages in trout eggs with the completion of major improvements, new water wells, and ultraviolet sterilization of water at our Sam Livingston Fish Hatchery, now once again one of the finest facilities of its kind in the continent. Finalization of design has been completed and construction started on a major new fish hatchery at Cold Lake, Alberta to cost $12 million.

Major improvements have been made to our Hunter Training Program with the production of an award-winning manual and we are now getting ready to handle compulsory training for first-time hunters. This was a prime objective of the Alberta Fish and Game Association, which is now being made a reality under the new Wildlife Act. The introduction of the Lanny MacDonald Awareness Program and Use Respect Program is designed to improve

hunter-landowner relations and avoid unnecessary access problems. Completion of a major upgrade to our field communication system is now complete, by which effectiveness of our enforcement officers has been greatly increased. Revitalization of the Buck for Wildlife Program has increased involvement of individual Fish and Game Clubs as well as the Alberta Fish and Game Association.

More effective fish and wildlife impact assessment and integrated land management planning is now a fact, with much better relationships between fish and wildlife managers and management personnel in other divisions and departments of the Alberta Government. This has resulted in increasingly visible benefits for wildlife and fisheries, as other agencies and departments of Government begin to overcome past hostility and begin to work actively with and for fish and wildlife. Accelerated progress has occurred working more effectively with Ducks Unlimited, Alberta Environment and Alberta Agriculture on the Wetlands for Tommorow Program. This year an emergency intercept feeding program was introduced to reduce ungulate mortality due to the severe winter following a dry summer. I could go on but I think I have made the point that real progress has occurred in Fish and Wildlife Management.

Another accomplishment which is a real one is that this has all been accomplished without any increases in budget. Budgetary increases over the last three years have been only $700,000 on a base of 26 million. That $700,000 is more than accounted for by statutory increases negotiated with unionized personnel. So, actual program dollars have not increased, and I believe we have much to be proud of in the way fish and wildlife are being managed.

I am sure that Mr. Surrendi and his senior staff are looking forward to the positive suggestions which will flow from your agenda and your discussions here and I am equally sure that as good ideas come forward the will will be there and the capability is there to implement and make changes and improvements.

I want to thank you and close with best wishes for an enjoyable, friendly and productive meeting.

SESSION I

MANAGEMENT PHILOSOPHIES AND RESPONSIBILITIES

NATIONAL WILDLIFE REFUGES - SOME STRATEGIES FOR THE FUTURE

ROBERT C. FIELDS
REFUGE MANAGER, KLAMATH BASIN NATIONAL WILDLIFE REFUGES
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It is with a great deal of appreciation, but some apprehension that I speak to you today. I am appreciative of the opportunity to share some thoughts on our responsibilities as wildlife biologists and managers. I am, however, apprehensive about the responsibility this carries, and my abilities to do the subject justice.

The topic for your conference, "Management in Alberta - Current Practices - Future Strategies" could be a topic in virtually any section of North America and be timely, simply by substituting any locality for Alberta. Review of current practices is something that all of us do in our agencies to gauge our effectiveness in achieving objectives, or to measure progress toward stated goals. Taking the next step and adjusting current practices into future strategies is quite another matter. Too often it seems that this becomes the difficult part of our jobs -- maybe because this is where so many other influences come into play.

Admittedly I know very little about your programs here in Alberta. I have, however, been around the U.S. Fish and Wildlife Service in the National Wildlife Refuge System (NWRS) for just a little over 27 years. This does not, in itself, make me an authority on anything, but with that amount of time in our organization, and being more than 200 miles from home, I am qualified to be known at least as an "informed source"! Seriously, though, I want to share with you some observations from our agency and the people of the United States that may be helpful to you in assessing future management in Alberta. I not only plan to present ideas and information, but to take many new ones from you back with me.

Our nation has made some substantial strides in wildlife management and research. Some we are very proud of are the National

Wildlife Refuge System, which now encompasses over 90 million acres in 400 units in 49 of our 50 states and five trust territories. Our Migratory Bird Conservation Stamp, better known as the "Duck Stamp" has just completed 50 years. Each migratory waterfowl hunter in the United States must purchase a duck stamp. Just recently I read where Canada will be initiating a similar program. Proceeds from the sale of our stamps go to purchase new waterfowl refuges. Many states have adopted similar programs to help fund a variety of activities benefiting waterfowl and upland birds. Legislation which imposes an excise tax on arms and ammunition has been a major source of funds for wildlife management, with these funds being distributed to the various states in proportion to the number of licensed hunters. Research programs at Patuxent Wildlife Research Center in Maryland and Northern Prairies Wildlife Research Center in North Dakota have greatly increased our knowledge of, and ability to, manage wildlife. Cooperative Wildlife Research Units at over 30 colleges and universities, jointly funded by the Fish and Wildlife Service, the various states and the Wildlife Management Institute have been a valuable training ground for future biologists and managers.

Jointly our countries have participated in many programs including extensive waterfowl banding efforts, cooperative enforcement efforts to protect endangered species, fostering programs for the whooping crane, to name a few. Even though much has been done, so much remains to be accomplished.

As we all realize, in this work we cannot spend too much time looking back. Wetlands drained, forests cleared, rivers dammed, and cities built are not about to be "un-built". By-and-large, "What we see is what we get". The important thing is what is done from this point on. An associate of mine once coined a phrase that I think is appropriate when we consider an action, when that same or similar action has been taken by someone else at another time and place, but under similar circumstances. He used to say, "It seems that people always reserve the right to make the same mistakes other people have made". Perhaps in this day of rapidly expanding human populations, the rush for energy development, wetlands disappearing

at an alarming rate, it is time we stop making the same mistakes and build on a foundation of common and shared knowledge.

It would be presumptuous of me to assume that we in the United States have all the answers and are not in the business of continuing to make mistakes, or at least, errors in judgement. In resource management, it seems no one holds the corner on either mistakes or good decisions. We all exhibit some of each. It is, however, in the spirit of sharing what we have learned over the past 75 years in the National Wildlife Refuge System, that I continue on.

By the turn of the century much of the westward movement and its unwritten policy of resource exploitation and wildlife decimation had taken place. The great herds of bison were nearly gone from the face of the earth. The passenger pigeon in the east had been brought to the brink of oblivion, not by killing the bird itself, but by destruction of the great hardwood forests that were its home. Native prairies in both our nations were turned into grain fields to feed two expanding economies. The christian ethic of "manifest destiny" had taken its toll and the rebuilding and preservation was to begin.

In 1903 when President Theodore Roosevelt designated a tiny island of about three acres on the east coast of Florida as the first National Wildlife Refuge to protect brown pelicans, few people had any idea that he was setting in motion a movement that would eventually encompass nearly 90 million acres in 75 years, with over 400 individual units.

Some of the first refuges were set aside to protect large mammals such as elk and buffalo. The National Bison Range in Montana and the Witchita Mountains Preserve in Oklahoma served as home for remnants of these herds gathered from zoological parks and zoos. With passage of the Migratory Bird Conservation Act of 1929 and the Migratory Bird Hunting Stamp Act in 1934, the addition of waterfowl refuges greatly expanded the refuge system. There was a great increase in the number of refuges in the 1930's; areas established to halt the decline in waterfowl resources that was occurring because of

the great drought in the midwest, drainage and liberal hunting regulations.

The growth of the refuge system in the 1930's was largely due to the efforts of J.N. "Ding" Darling, a cartoonist who was brought into President Franklin Roosevelt's administration as head of the Bureau of Biological Survey, the predecessor of the Fish and Wildlife Service. He convinced President Roosevelt to establish a "Duck Committee" to acquire lands that could serve as waterfowl refuges. He also designed the first Migratory Bird Hunting Stamp. Another member of the committee was Aldo Leopold, who is to many of us, the "father of modern wildlife management".

The refuge system has continued to expand since the hey-day of the 1930's. Areas have been set aside as mitigation areas for water developments. Refuges were purchased in the Central Valley of California to feed the hordes of waterfowl wintering there and reduce depredations on crops. Areas have been added to the system that are urban refuges, established in the shadow of some of the largest metropolitan areas in the states. Vast expanses of bottomland hardwoods were purchased for refuges in the southern United States. The largest expansion has, of course, taken place in Alaska with the passage of the Alaska Lands Act. The new areas in Alaska have essentially doubled the size of the refuge system and added a new dimension to our program.

Although refuges have been established for a wide range of birds and mammals and, in fact, some plants, the major thrust of the refuge system has been, and continues to be, migratory waterfowl. Treaties between the United States, Canada, Mexico, Russia and Japan have, indeed, made management of refuges and migratory waterfowl an international experience. Migratory waterfowl continue to be the most common resource management bond between our two nations.

As would be expected, the role of the National Wildlife Refuge System has changed over the years. From the early units being closed sanctuaries, many refuges now host a variety of human activities including hunting, boating, auto tour routes, outdoor education centers and a wide variety of other "non-consumptive" uses. Also

present are a range of economic uses such as farming, grazing, haying, timber harvesting, oil and gas development, commercial fishing, trapping and even bee keeping. Indeed it comes as somewhat of a shock to many refuge visitors to see such a wide range of activities on areas that are in their minds devoted exclusively to wildlife and its needs. Have we perpetuated a great hoax on the American people, or are we, in fact, accomplishing what is the stated mission of the National Wildlife Refuge System? I believe the latter to be true.

A reading of this Mission Statement reveals the following: "The specific mission of the NWRS is to provide, preserve, restore, and manage a national network of lands and waters sufficient in size, diversity and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available."

Under the umbrella of the mission statement are four major Goals of the NWRS.

1. To preserve, restore, and enhance in their natural ecosystems (when practicable) all species of animals and plants that are endangered or threatened with becoming endangered.

2. To perpetuate the migratory bird resource.

3. To preserve a natural diversity and abundance of fauna and flora on Refuge lands.

4. To provide an understanding and appreciation of fish and wildlife ecology and man's role in his environment, and to provide refuge visitors with high quality, safe, wholesome, and enjoyable recreational experiences oriented toward wildlife to the extent these activities are compatible with the purposes for which the refuge was established.

Considering the geographic range of the System, the broad spectrum of species protected and managed, the many and varied local socio-economic conditions in place when various refuges are acquired, and other wide-ranging factors, it is easy to see that the mission statement must be broad in nature. But, implicit in both the mission statement and goals of the NWRS, is the dedication of the system to our nation's wildlife resources. This is the common thread that ties these 90 million acres together. Managers and administrators must be the ones who determine what is compatible within the system in the form of recreational and economic uses. This is why some areas have haying and grazing, for example, where it can be used to manipulate vegetation to benefit wildlife habitat.

It is not difficult to understand, for example, the mission of the National Park System in the States. Their role is to preserve and protect an array of natural, scenic and historic resources, unincumbered with the vagaries of an ill-defined concept called "resource management". From limited visits to the Canadian park system, I would imagine their role is similar in nature. It is often more difficult, however, for the average citizen, or refuge visitor, to understand why refuges, whose very name invokes protection from danger or distress, permit killing of animals in the name of public hunting, permit extensive grazing of domestic livestock at times and places which appear to be in direct competition with wildlife, and spend limited monetary resources on public use programs.

On the other hand, there are those (many of whom are <u>not</u> outside the political mainstream in society) who firmly believe that the refuge system is too restrictive and stifles not only local economic programs but in fact, can impair national programs. In their view large tracts of rangelands should be explored and developed; refuge wetland meadows should be available to local ranchers for hay production -- regardless of the impacts on wildlife populations and habitat. It is the balancing of these two divergent viewpoints, while considering all applicable laws, regulations, policies, legislative directives and administrative thrusts that creates the art and

science of refuge management. After 27 years in the business, I firmly believe it is more of an art than a science!

What have we learned about this combination of art and science that we call management over more than half a century of practice? How have we been at not making the same mistakes over and over? How do we manage to continue to expand a system of lands that is already larger than any other similar effort on the face of the earth? How indeed!

First, it is obvious that, under our democratic system of government, the people of the United States deem it important to acquire, maintain and expand, if necessary, a system of lands dedicated to wildlife. Without this underlying support there would be no enabling legislation or appropriation of funds for the System. This support not only comes from the nearly 27 million people who visit refuges each year, but also comes from people who have never been outside a metropolitan area, but support the concept of a system of lands dedicated to wildlife. We have found this underlying support to be extremely durable. Efforts to minimize or reduce the importance or size of the refuge system have largely been counterproductive. For example, a move in Congress in the late 1970's was aimed at turning over administration of several large jointly administered game ranges, large units within the refuge system dedicated to big game species, to a sister agency in the Department of the Interior, the Bureau of Land Management. The outcome of this attempt was a strengthening of the National Wildlife Refuge System Administration Act, one of our basic legislative operatives, stating in fact that all units of the NWRS shall be managed by the Fish and Wildlife Service. The question of who has ultimate administrative authority on jointly administered areas has been laid to rest. The people have spoken through their elected representatives. This had profound impact on several areas, not the least of which was Klamath Basin Refuges, since we are involved in joint management of four refuges with the U.S. Bureau of Reclamation.

A second realization that is becoming more and more apparent as each year passes is that the 90 million acres of lands within

the NWRS is not, in itself, sufficient to prevent the decline of some important wildlife resources. It can't be done by one agency alone. When dealing with migratory waterfowl, it can't even be done by one country. Some who look at the size of our system will ask the legitimate question, "How much is enough?" Some even advocate a limit on the amount of land that can be owned or managed by the Service or other federal land management agencies. Their fear is the destruction of the free enterprise system which is so dependent upon the private ownership of lands.

Much of what we do on refuges in the States is premised on the fact that we are responsible for management of a migratory resource under international treaties. We do not stand alone in this responsibility. It is shared by many of you in this room on a day-to-day basis, whether you are a biologist, administrator or legislator. Much is done to share information and coordinate management of resources, including cooperative banding, census work, and the formulation of regulations through the Flyway Technical Committees and Councils. When there are enough birds for everyone, the work goes along quite well. It is during times of scarcity that things get tough -- like they are now on several fronts concerning migratory waterfowl.

Having worked in the upper midwestern states for several years, part of that time managing a refuge that had a common border with Manitoba and whose water supply largely came from Saskatchewan, my interest in our common problems expanded greatly. It became aware to me that international forces on our waterfowl and wetland resources were considerable and, in some instances, going largely unaddressed.

Beginning in the late 1950's, in response to the accelerated drainage of wetlands in the midwest, the Fish and Wildlife Service launched an aggressive campaign to reverse this trend. With the support of Congress, the Wetlands Act was passed and put into place, with the Service implementing a program of acquisition of small wetland areas and the taking of easements on private lands that prevented the drainage or filling of prairie potholes. Private land-

owners were compensated with a one-time payment and the easement became a restrictive part of the deed to the property, assuring that the wetlands would remain "forever". At the time this program was put in place it was already too late for some of the historic wetland areas in states such as Iowa and much of southern Minnesota and eastern North and South Dakota. Agricultural drainage had already taken its toll -- much of it financed by another agency of the federal government in the name of increased agricultural productivity. As might be expected, this program met with varying success, depending upon political administrations, support in the local area, land values, the attitude and performance of Fish and Wildlife Service personnel in administering the program, and of prime importance --- the value of the grain crop that could be grown on drained wetlands. While in North Dakota in the late 1960's the price of durham wheat went to over $8.00 a bushel, largely on the basis of export demand, the pressure to drain wetlands and put more land in production became intense. The land buyers for the Service had some stiff competition.

It became apparent to me that the survival for our waterfowl resources may well be in the hands of the international grain exchanges to a greater degree than we would like. At that same time, through my travels and professional contacts in Canada, it was apparent that there was not in place a similar program of wetland preservation north of the border. In fact, there was, depending upon the Province, programs of varying aggressiveness to bring more land into production, either through the drainage of wetlands in the south or clearing of parklands in the north. In addition there were basically different ways of looking at the problem of crop depredations between the two countries.

Wetland drainage north of the border not only had an impact on loss of waterfowl habitat but it greatly accelerated the flow of water in the Souris River in the spring. Combined with drainage in the local area, we experienced three 100-year floods in a span of four years. That can't happen now -- not because the drains have been plugged but because the criteria for a 100-year flood has simply been upgraded to meet the new runoff potential of the watershed.

This example is not brought forth to point fingers or to accuse anyone of not living up to the spirit and intent of international treaties. That is not my intent at all. It would not only be presumptuous, but foolish, of me to assume we are doing a better job than anyone else. With the continued loss of over 400,000 acres of wetlands a year in the United States we still have a long ways to go. I talk about this simply to illustrate the importance of having programs all throughout the range of our migratory waterfowl that address resource needs. These programs are going to vary greatly between countries, provinces and states depending upon the economic and political realities. They must, however, be consistent in their intent to preserve important habitat.

There has been, and continues to be, a great deal of false hope and failure to face realities amongst not only hunters, but professional managers as well. It is never more apparent to me than when we have declining duck populations. The first thing that is mentioned is the drought in the Canadian prairies. As soon as the wet cycle returns, all will be well! Certainly it is true that when the Canadian prairies are wet that duck production benefits. But, can we continue to assume that the Canadian prairies will always be productive wetland areas? I doubt that we can. Also, it is not facing reality to think that one geographic area, or one element in the breeding ecology of waterfowl is the key to their survival. What good are wet Canadian prairies if birds returning from their wintering grounds are in poor condition and cannot successfully breed and raise a brood of ducks? Work by Leigh Frederickson and others has shown the importance of quality wintering habitat to get waterfowl in breeding condition.

Private organizations have a stake in this matter as well. Ducks Unlimited has generated millions of dollars to better waterfowl habitat. But the Ducks Unlimited member who tells me that I would not have a job if it were not for Ducks Unlimited is sadly misinformed. No one entity, be it the United States Government, the Province of Alberta, the Canadian Government, or Ducks Unlimited can claim to be the key link in the survival of our waterfowl resources.

The third thing that I think we have learned from managing refuges is the need for a program that is consistently and unequivocably based on wildlife resources. Without this dedication permeating an organization, and being the "bottom line" it would be impossible to continue to manage refuges for the benefit of wildlife. All management decisions eventually come back to the premise of whether or not an intended use is compatible with the reason for which the refuge was established. For example, if an area was acquired as a waterfowl production area in the mid-west, economic uses such as haying, farming and grazing must be done only to support land management programs. Grazing and haying can be used to manipulate vegetation to keep it productive nesting habitat -- in some situations. Farming can be used to prepare seedbeds for reseeding native prairie, or to provide food for migrating waterfowl. In the same manner, public use programs must not interfere with the basic wildlife values of an area. Hunting programs must not only be in line with available wildlife resources but must be administered in a manner that does not detract from the value of the refuge.

In some instances it took the Fish and Wildlife Service many years to change management programs. A scenario had been repeated that permitted things to get out of line. Commitments were sometimes made to facilitate acquisition. If these commitments were counter to the wildlife objectives of the area, and were long-term in nature, they were often difficult to change. Even in the face of drastically deteriorated habitat conditions on some refuges, it has been a major political effort to bring management in line with refuge objectives. We, as managers, were often guilty of permitting economic uses because they were easy, made people happy, and we did not have the scientific data to document the need for change. It is important, therefore, to establish aggressive wildlife management programs early, if at all possible. This takes personnel, equipment and money. We have been trapped too often in letting economic uses continue until funds were available for habitat development, only to find that the economic uses are firmly entrenched and difficult to

alter. Sometimes refuges are relatively easy to acquire in comparison to securing adequate funding for development and management.

The final lesson that I would like to mention is the need for a program to be flexible. I do not mean flexible in that management of an area should change on the whim of a biologist or manager, or with the change of political administrations. My reference is to the system being responsive to the ever-changing needs of both the resources and society. This flexibility must be built into the system for it to be effective in the long run. Opportunities simply do not exist to establish large refuges such as the Charles M. Russell Refuge along the Missouri River in Montana, or to set aside tracts of wintering waterfowl habitat such as exists in the Sacramento Valley Refuges in California. Some of us have had to rethink our definition of a National Wildlife Refuge.

When the prairies were blowing away in the dust storms of the 1930's, who would have thought that units of the NWRS would be located in downtown Philadelphia, Pennsylvania 30 years later? Who would have envisioned a major addition to the refuge system in San Francisco Bay, encompassing what were considered to be sterile and unproductive salt evaporation ponds? Many of us within the system questioned the wisdom of spending millions of dollars for unproductive habitat in San Francisco Bay that was, by the Service's own admission, going to remain largely unproductive of wildlife until the commercial salt operations could be terminated long into the future. Couldn't those dollars have been better spent on prairie wetlands or wintering waterfowl habitat? We don't question the decision anymore, now that we have an opportunity to visit a functioning, dynamic refuge organization right in the middle of a megalopolis of several million people. Were dollars spent for an environmental education center at San Francisco Bay really needed worse somewhere else? The challenge was there --- to establish a refuge in the midst of one of the most highly industrialized, drastically altered, heavily populated, fastest growing areas of our nation. We have begun to meet that challenge. This is the kind of flexibility I am speaking of.

Enactment of the Endangered Species Act in 1973 caused the NWRS to be thrust into a highly emotional and often controversial program. It almost immediately caused us to examine our management of refuges to see what we were doing for, or against, the welfare of listed species or potentially endangered species. When it cam time to do planning on refuges, or to articulate objectives for a unit, the Endangered Species Act had to be taken into consideration right up front. We not only saw management of areas change, such as lands in the Central Valley of California being dedicated to such unfamiliar creatures as the Blunt-nosed leopard lizard instead of being flooded and turned into wintering waterfowl habitat. We also saw the acquisition of new refuges solely for the protection of endangered species, such as many of our units in the Hawaiian Islands. In the Klamath Basin, lands were purchased to protect a communal night roost for the endangered bald eagle. We saw re-introduction programs such as the Aleutian Canada goose that changed traditional waterfowl hunting in their wintering areas. All of a sudden, hunting of Canada geese had to stop because the small, endangered race from the Aleutian Islands was wintering in the same areas as the larger races. We saw refuges established for obscure, tiny, fishes in the desert wastelands of Nevada. What kind of NWRS is this that must incorporate fish you can hardly see, let alone not eat! What the Endangered Species Act often did was bring us kicking and screaming into the 20th century. It made us look at refuge units from the standpoint of ecological units which had to incorporate a variety of management objectives, rather than be single-purpose areas with management basically insensitive to "lesser species".

Support for traditional endangered species had been an integral part of the refuge system for many years. It manifests itself in the whooping crane, buffalo, or trumpeter swan; animals that were magnificent and easily captured the hearts and pocketbooks of the taxpayer. The joint efforts of our two countries in the preservation of these species is a tribute to international cooperation and scientific innovation.

Another aspect of flexibility that has become an issue within, and outside, the FWS is the matter of native subsistence hunting. Under the Migratory Bird Treaty Act (MBTA), natives in Alaska are restricted to taking certain sea bird species and their eggs for subsistence. The real situation, however, is and has been far beyond that designated in the Act. With statehood for Alaska came the dividing up of lands between the state, federal agencies and native corporations. With the passage of the Alaska National Interest Lands Conservation Act in 1980, the refuge system more than doubled in size with large refuge units superimposed on native corporation lands. The reality of subsistence hunting of waterfowl has now become a day-to-day reality for managers in Alaska. The impacts reach far beyond the state boundaries and indeed include Canada, as you face similar situations in the north. With sharp declines in Arctic nesting white-fronted and cackling Canada geese, sport hunters in the lower 48 are taking note and feeling the impacts in restrictive regulations. I am not saying that subsistence hunting has been the reason for the decline in Arctic geese. When there were plenty of geese to go around and seasons and limits were liberal in the lower 48, it was not an issue. As soon as restrictions came into place, it became an important issue no matter what the various reasons for the declines in goose numbers. It is, of course, beyond the authority and responsibility of refuge managers to change the MBTA. It is, in fact, an international effort that has been underway for several years but is stalled for various reasons. My point here is that we must be flexible in dealing not only with biological but with social and cultural issues as well.

Not being familiar with your situations here in Alberta, or your relationship with the federal government in Canada in management of wildlife resources, I am not going to attempt any comparison of your systems with ours in the states. Perhaps a sharing of information, ideas, experiences and philosophies will help us all to be better prepared to manage out wildlife resources in the future, no matter what our political affiliation. Preservation and management of wildlife, especially migratory birds, should transcend inter-

national boundaries where appropriate. We have a historical pattern developing that can, and should be built upon in the future.

In looking back over the history of 75 years of management of National Wildlife Refuges, we see our success and failures in the perspective of today's management programs. Our mission statement and objectives have been formed not only from legislative authorities but from a historical perspective as well. The real question is how are we going to handle things in the future. Are we willing to accept what we have now? Will our ideas and programs serve the needs of the wildlife resource and the needs and expectations of the public, for which these resources are protected and managed?

In an effort to find out more about the American public's perceptions, the Fish and Wildlife Service commissioned a study in 1977 to examine "American Attitudes and Behaviors Toward Wildlife and Natural Habitats". This study was done under the direction of Dr. Stephen R. Kellert through the Yale University School of Forestry and Environmental Studies. There were five separate reports from the study; four of them based on personal interviews with 3,107 randomly selected adults in the 48 contiguous states and Alaska. The fifth report was done on children's attitudes, knowledge and behaviour toward wildlife, and was limited to the study of school children in the state of Connecticut. The first phase of the study released in 1979 addressed American Attitudes and Behavior Toward Wildlife and Natural Habitats. Topics covered in the interviews for this report included endangered species, animal damage control, habitat preservation, consumptive uses of wildlife (e.g., hunting, trapping), wildlife management, and use of back-country and parks. Responses were analyzed according to the respondent's age, occupation, place of residence, and other factors. On many questions the respondent's level of knowledge was considered in analyzing results. Some of the major findings were: (1) On a variety of questions, a majority favored protecting wildlife even at the expense of jobs, housing, and development projects; (2) The public's support for endangered species protection when it would increase costs for an energy project depended on the animal involved and the nature of the project; (3)

The public supported traditional native American subsistence hunting, and hunting for recreation only, particularly trophy hunting; and (4) Of all regions, Alaskans were the most knowledgeable about and supportive of wildlife.

The other report in the study which I would like to mention dealt with Knowledge, Affection and Basic Attitudes Toward Animals in American Society. This report focused on three areas: (1) Knowledge of animals, including awareness of wildlife management issues; (2) Species preference (i.e., most like and disliked) in relation to critical wildlife issues; and (3) Basic attitudes toward animals.

Certainly there would be some differences in results if a similar study were done in Canada, but there would in all probability be some very close parallels given our common cultures, political systems and lifestyles. With this in mind, I would like to cite some specific aspects of these two reports that I think are interesting and useful in our work as professional biologists and managers.

To assess public awareness of wildlife management issues, respondents were asked to indicate if they were very, moderately, or slightly knowledgeable, had very little knowledge or had never heard of eight wildlife management issues. Since this question solicited perceived knowledge, one could expect the average person to somewhat inflate or exaggerate their level of understanding. Despite this tendency, no more than 15% of the national sample reported themselves as "very knowledgeable" on any of the eight issues. The eight issues, in order to the greatest percentage of people being very or moderately knowledgeable were:

(1) Killing baby seals for their fur;
(2) Effects of pesticides such as DDT on birds;
(3) Using steel leg-hold traps to trap wild animals;
(4) Endangered Species Act;
(5) Killing of livestock by coyotes;
(6) Tuna-porpoise controversy;
(7) Tennessee Valley Authority Tellico Dam/Snail Darter issue; and

(8) Use of steel shot versus lead shot by waterfowl hunters;

Kellert identified a number of impressions derived from these results. First, the public was not especially aware of any of the issues, with no issue recognized to a moderate or very knowledgeable extent by a majority of those surveyed. Second, the public appeared to be far more aware and, in all likelihood, concerned about relatively emotional issues involving specific, attractive, large and phylogenetically "higher" animals, than issues involving indirect impacts on wildlife and dealing with biologically unfamiliar and "lower" animals. Finally, a wide disparity appeared to exist between the public and the professional wildlife manager regarding the most important wildlife issues. The baby seal controversy at the top of the list and the lead/steel shot issue at the bottom exemplifies this quite well.

Results like these are, of course, influenced by when the questions are asked. This survey was done in the late 1970's and reflects the relative importance at that time of the specific issues surveyed. However, the low level of knowledge, and the relation of emotional versus scientific issues would probably not change if the same survey were done today, asking a different set of questions. Based on my observations over the years, I found no surprises in these results. All one has to do is read the newspaper, watch TV and listen to what our constituents say to recognize what Kellert validated in his surveys.

Another interesting finding was that for the most part, Americans appeared to possess an extremely limited understanding of animals. For example, only 25% knew the manatee is not an insect, and just 13% knew raptors are not small rodents. On the other hand, four questions were accurately answered by at least 70% of the general public. These questions dealt with human injury inflicted by animals, highly familiar animals, common historical practices and domestic animals. Some further interesting findings were that demographic groups with the greatest knowledge of animals were the college educated, especially those with a graduate school education,

residents of Alaska and the Rocky Mountain states, males and those who rarely or never participated in religious services. Especially high knowledge scores were obtained by bird-watchers, members of various conservation-related organizations, hunters who hunted primarily to be close to nature, and scientific hobbyist, as well as members of the National Trappers, National Cattlemen's and American Sheep Producers Associations. Groups with relatively low knowledge scores included zoological park visitors, hunters who hunted primarily for sport or recreation, anti-hunters and fishermen.

There should not be any surprises in this information either if we have been aware at all of public attitudes toward our professions and animals in general. It is good, however, to reflect on the findings. They should cause us to think of how we might be more effective in telling our story.

Now, a few quick observations about American's attitudes toward critical wildlife and natural habitat issues. Although Kellert found relatively low knowledge about wildlife and animals in the general public, there was support for actions to protect habitat for wildlife, whether it was endangered or not, even if it meant some degree of hardship such as fewer jobs or higher prices. In the survey 56% agreed, in response to a hypothetical question, that five million acres should be set aside for the protection of the grizzly bear even if it meant fewer jobs and loss of some building materials. Another hypothetical question asked if a developer should fill a marsh to build a plant that would employ 1,000 people if it would destroy land needed by a rare bird. Over 50% surveyed voted for the bird. Even when the species involved was not endangered, there were 57% disagreeing that a housing development should be permitted if it were to fill wetlands needed by non-endangered wildlife. Similar responses were obtained in relation to wilderness development and in support of forest management practices that support wildlife.

Some findings that may be more comparable to parts of your province were the finds relative to residents of Alaska. Kellert's study revealed exceptional animal knowledge, ecological appreciation, interest in wildlife, and relatively less utilitarian orientation

among Alaskans. The indication of a relatively strong Alaskan affection for and desire to protect wildlife and their natural habitat, even at the sacrifice of various material benefits, somewhat contradicts many media descriptions of the Alaska citizenry as development oriented. The power of the press is great in formulating attitudes. As noted earlier, the baby seal issue was the one on which more Americans felt very knowledgeable over the other seven issues presented. Where did they get the information to form opinions? It most certainly was not from first-hand experiences. It was through the press.

Perhaps we are not utilizing the press effectively to educate and inform the public on those mattes we feel and know are important resource issues. Then again, our issues may not be charged with enough emotion or are not directed toward a species for which the public has a great deal of sentiment. Resource issues are, in my judgement, rarely newsworthy unless they threaten a significant section of the economy. An outstanding example of this is going on in the Central Valley of California at this time. Irrigation waste water is concentrating selenium in reservoirs within a National Wildlife Refuge, resulting in deformed embryos and young birds. This was news of slight interest when first reported. It became more newsworthy when health officials warned against eating migratory waterfowl from the area because of the human health hazard. But it really became news when the Secretary of the Interior ordered the drain closed and no more water delivered to over 40,000 acres of irrigated croplands that drain into the canal and eventually the refuge. There was some concern for the hazard presented to migratory waterfowl from selenium, but it does not begin to compare to the concern for the loss of income from irrigated agriculture. But what justification did the Secretary use in ordering the drain closed? Protection of birds under the Migratory Bird Treaty Act!

Maybe we have come a long way since Aldo Leopold in 1949 wrote his essay, The Land Ethic, stating the following: "One basic weakness in a conservation system based wholly on economic motives is that most members of the land community have no economic value. ---

Yet, these creatures are members of the biotic community, and if (as I believe) its stability depends on its integrity, they are entitled to continuance. --- When one of these non-economic categories is threatened, and if we happen to love it, we invent subterfuges to give it economic importance. --- We have no land ethic yet, but we have at least drawn nearer the point of admitting that birds should continue as a matter of biotic right, regardless of the presence of absence of economic advantage to us".

I am not ready to say that there is now a land ethic in the United States. However, the passage of such legislation as the Endangered Species Act and the various Wilderness Preservation bills heads us in the right direction.

There are enough graphs, charts, figures and compilation of variables in the Kellert studies to keep even the most devout statistician starry-eyed for days. But, overall, it is good reading for all of us. Not that it reveals any great conclusions that we should not have generally been aware of on our own, but it does ratify much of what we thought we knew. Some of the findings will certainly challenge us, and in some instances, make us feel threatened. But as Kellert noted in his conclusion to the Phase II Report: "Many changes have occurred and are still taking place among Americans in their perceptions and values of wildlife, with many areas of traditional concern inevitably being affected by these shifting forces and constituencies. While it may be possible in the short run to avoid the implications of these changes, in the long run, this would probably be counterproductive as well as neglectful of what may be exciting and challenging opportunities. --- Without question, public perceptions should not dictate policy, as if management efforts were subject to some kind of popularity contest irrespective of best professional judgement. On the other hand, human dimensions information can provide valuable insights, suggesting not only broad policy guidelines and directions, but also some understanding of the public's need for greater awareness and education".

We, in the NWRS, need only to read again the mission statement and goals of the System to see the importance of what Kellert

and his colleagues have affirmed for us. The Special challenge is not to the manager, but to the administrators and legislators who will be making the decisions about future acquisition and management programs. History has shown our efforts to be worthy. Concern for our environment has captured the conscience of a nation.

What strategy to develop for the future? It is simple enough. Meet every challenge and take appropriate action to preserve our special relationship with the environment. Easier said than done? Certainly! But what are the alternatives? We need only to look at other sections of the globe to see the devastation of natural resources that has taken place. Yes, we may reserve the right to make the same mistakes others have made, but we don't <u>have</u> to exercise all our options!

FISH AND WILDLIFE MANAGEMENT OBJECTIVES

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First of all, I would like to express my appreciation to once again speak before this Symposium. I really felt that the topic was timely for this kind of discussion to take place. We had a discussion a couple of years ago where we dealt with the various elements of Fish and Wildlife policy and I found that much of the proceedings of the discussion at that Symposium were very valuable to us in Fish and Wildlife in Alberta to give us some direction and assist us in doing a better job. Now there is no doubt in my mind that the deliberations of this particular Symposium will be very carefully examined from the standpoint of this division's mandate, with the view of seeing where we can be more effective in carrying that mandate out.

Fish and Wildlife from an organizational point of view is very fortunate in Alberta to have a policy framework that is endorsed by a full government caucus forum. The Fish and Wildlife Policy for Alberta was passed in 1982 and of more recent vintage a key document - the Fish and Wildlife Resource Status Report or Declaration and many other lesser policy items have been passed through government after very exhaustive examinations. Now all of these documents constitute a policy framework that is unmatched in this country in terms of support at that level. There are many fish and wildlife agencies across Canada which have policies. But none has ever been endorsed by a full government. And I think that is a very significant point one of which I dwelt on at length at the last Symposium. In summary, what I'm saying is that we really now have a very clear set of government-endorsed principles and goals and these will form and are forming the basis for more definitive objectives both from an administrative and from a resource standpoint, to be put into effect for the coming years. And only our creative minds will limit how those in fact can be implemented. How effective this government and the

Fish and Wildlife Division will be in delivering these policies will depend on a variety of factors many of which in my judgement will be influenced by the deliberations of this Symposium.

My original intention was to reflect on some future perspective for fish and wildlife management in Alberta. In other words, what should we do differently in the future that we have not done in the past to achieve a higher level of success as resource managers. To set the stage for what I'm going to say I should state that as sciences go, fish and wildlife management is fairly primitive. In my judgement and following Mr. Field's comments, I believe it to be more of an art form melding factors that range from very scientific disciplines to folklore, neither one of which may have precedents at any particular time. So sometimes fact does not have any relevance if it's in an incorrectly presented form. Other factors also must be considered. Fish and wildlife creatures and the ecosystems that support them are exceedingly complicated. Their complexity is one of the reasons that it's usually very expensive to study them even if you want to know how many of them there are. It is also useful to observe that wild animals often live a number of years and studies must be planned on the basis of their timetables rather than ours. In a similar vein, it is the wildlife usually that decide what a population is, and is not those of us who study them. And more often than not, what we call a population of this or that is usually simply what we found in an area that was convenient to study. Now as if this were not enough, it is also obvious that wild animals of different species interact with each other as competitors. To treat them one species at a time, as we are sometimes prone to do, may be convenient, but I think we all recognize that it is not realistic. It is equally unrealistic to leave out consideration of the ecosystem of which fish and wildlife are a part. Therefore, wolves, bears, moose and willows are a package that cannot be looked at piecemeal. It also pays to remind ourselves and others that the complex fluctuations of abundance, what we call the so called cycles, of much of wildlife and fisheries are almost as

mysterious today as they were when the fur traders witnessed them a couple of centuries ago. Much of what we do in fish and wildlife management is still of a very descriptive stage and a lot of it is repetitive for usually no two areas are quite the same and each one has its own prescription for management.

To complicate things even further, from my experience in a broader realm of natural resource management, the subject of fish and wildlife management is emotionally charged and thus the most politically sensitive area that I have ever encountered. This is particularly true of wildlife management and "the consumptive use" of wildlife as a renewable resource. Rather than expand on some of the reasons behind this, I think that the reasons are left to another more comprehensive treatise. But for the time being I would like to just emphasize, as I think I have perhaps before this group in the past, that it should be really clearly understood that if it has brown eyes and hair we should be really careful as to how we handle it. It is also notable that there is surprisingly little in the way of experimentation, particularly in wildlife studies. More and more I find that we are prone to observation from an aircraft followed by some form of religious interpretation of what we saw. Indeed there are some professionals in the field who have come to believe that such results are actually science. Many modern wildlife managers console themselves by using computers to massage this data. But we should be careful not to let this influence our judgement. It is very easy to program a computer to print 1 plus 1 equals 3. My point here is that the information is still primitive and perhaps irrelevant in many cases but it can be plugged into a very fancy mathematical formula and a printout to rationalize a particular perspective.

The culmination of all of this from my experience is that in order to demonstrate the usefulness of data we somehow have come to demonstrate their "usefulness" by developing another annual set of regulations. There seems to be some direct correlation between how effective we are as managers in this particular resource area and how complicated we can develop the law and, in fact, impress upon others our sophistication "in science". As I mentioned earlier, this entire

process on occasion appears designed not only to impress the publicly elected officials but also other professionals as to how really fine-tuned the science of fish and wildlife resource management really is. A specific case in point related to the status of wetlands in the prairies of Canada and the United States. How many research studies and surveys of waterfowl have you known that secured wetlands in the face of agricultural development? Factors affecting the decline in wetlands and waterfowl were outlined in the Saskatoon Wetlands Seminar held in February 1967, sponsored by the Canadian Wildlife Service.

Those factors influencing the declining wetlands in prairie Canada and the United States are as relevant today as they were then almost two decades ago. Now this has to lead me to conclude that whatever we have done since has not been very effective in influencing use of land and water for wildlife. Now, with the current and foreseeable economic and social demands and increased pressures on the land and water base in Canada are inevitable. If a place for the fisheries and wildlife resources is going to persist, it is going to have to be fitted in with whatever else is going on or it will end up being as one previous speaker once indicated "away to hell and gone where you can't produce anything else". It is neither realistic nor constructive to expect it will be otherwise in the years to come.

Now some of you may not agree with what I have said. However, in my judgement it is imperative that we appreciate how others perceive us, including, I might add, some of our own lot. It is within this context that I would like to address what I believe we should be looking at carefully or to do differently to be more successful in fish and wildlife management in the future. From my experience, I have identified eight areas where initiative is needed to achieve higher levels of success in securing a place for fish and wildlife resource interests. These eight areas are:

1. Policy of government;
2. Academic training;
3. Research;
4. Resource and management information needs;

5. Being more pragmatic and empirical;
6. Non-government involvement;
7. Understanding our clients; and
8. Professionalism.

As I've stated before, here in Alberta (and I would suggest it should be strived for elsewhere) a policy foundation has been established by the government as a whole to form the basis for programming and legislation. Because of the diverse social attitudes relating to fish and wildlife, if any Minister needs the support of firm policy it is a minister responsible for fish and wildlife management. I believe we've achieved that here now and, in fact, having it in place, constitutes one of the most important aspects of Fish and Wildlife Management in this province.

Effort should now be placed, in my opinion, toward the development of a specific fish and wildlife management curriculum in the universities of this province. In my judgement, that will yield a student product better equipped to step into the resource management field. Furthermore, serious consideration should be given to the establishment of government and university formal interfaces or agreements, perhaps much along the lines of cooperative units similar to those found in some of the universities in the United States. Such arrangements would allow for long-term programming arrangements to be struck between universities and government agencies. It would also allow mutually valuable experience for the student and the staff of an agency in government to be involved in valuable, practical resource management experience or instruction on real management issues. And for the student, it will provide, as well, invaluable administrative experience which is something that you undoubtedly will not be able to get in any institution or curriculum at present. You have to get on the street for that and I think it's time that we brought students into these experiences before we finally let them loose on the land.

Practical research would ensure that both the student and government agency would have the satisfaction of seeing immediate application of research findings. This action I believe would bring

us closer together through common understandings so we can get away from academics and resource managers publicly sniping at one another, serving no one any positive purpose. On a further matter of scholastic requirements, in my judgement there is another perspective that deserves consideration. I believe greater use of individuals lacking formal education but possessing extensive practical experience should be employed in dealing with some of the more routine aspects of fish and wildlife management. I recognize this has taken place to some degree in the past but I am suggesting that there be more formal recognition of this talent. Along this line we are considering a concept called the Fish and Wildlife Resource Assistant concept that would deal more formally and effectively with the use of this talent although unschooled in terms of the individuals involved, but invaluable with respect to the experience that they provide to an agency such as ours.

My third item is research. It is, in my judgement, imperative that we formalize the interface in terms of roles and responsibilities between all government agencies, universities, industries and individuals on matters of fish and wildlife research. This is needed to sort out what I consider to be a confusing and cost-ineffective and inefficient situation that currently exists. I think that the expectations of government agencies from other sources of interest in the public may have to be clarified and our expectations of universities and industry and other individuals should be clarified so that at least we have some general framework that we can work within.

My fourth point concerns resource management information needs. It is essential that a more cost-effective and efficient approach be developed in the collection and use of fish and wildlife resource and habitat inventory information. Basic to all of this, of course, is a need to establish some standards that will provide a reasonable level of confidence to make decisions with the information for resource management requirements. What I'm finding from my experience is that we have on some species 99.9% confidence, but on the other hand, we are attempting to manage other species with that

same level of sophistication with 50% confidence in the data. I think we have to be honest with ourselves and maybe strive for 80% confidence on everything, including non-game species. What I'm saying in this area is that we must improve our confidence in determining what is out there because we are being requested to make decisions of a level of sophistication that does not allow us to use the information with any credibility.

My fifth point involves being more pragmatic and more empirical. Fish and wildlife agencies, as I've earlier stated, tend to focus quite a bit on documenting the loss of fish and wildlife resources as historians. We must become more effective and proactive in dealing with land and water in the interests of fish and wildlife resources and we must become more effective in using what we already know. It is simply not sufficient to let fish and wildlife have the leftovers and hope for the best. What is needed is a positive and constructive effort to maintain or develop habitat that is particularly designed for fish and wildlife in order to constructively compensate for what is otherwise "lost" or changed. This action cannot afford to wait while we do endless surveys and research to document what we haven't got anymore. My principle point here is that wherever the continuance of supply of fish and wildlife can be better insured by the creation of more suitable habitat, an aggressive program of habitat enhancement should be undertaken both on private and on public land. What will be needed are many more ways of giving fish and wildlife a boost wherever they can be given a boost. It is habitat that is so fundamental to the future of fish and wildlife regardless of what user perspective one may have.

My sixth item is non-government involvement. Greater non-government involvement in all aspects of fish and wildlife management activities is becoming more and more essential and unavoidable. The past philosophy that only government is capable of managing fish and wildlife must be changed. Government simply cannot do it all. And I don't believe they should be expected to either. Policy in legislation and programs are needed to encourage private land owners and industry to play a positive role in supporting fish and wildlife

resource interests. Greater involvement of experienced non-professionals in such programs as species population and habitat inventory, habitat enhancement, etc. is really required. We have a couple of examples of program elements in Alberta that I think reflect this kind of involvement. They certainly are areas which we can expand and in fact should consider expanding into other program element areas. Those two areas are the Outdoor Observer Program in support of fish and wildlife enforcement and more recently the Buck for Wildlife Program, both of which have really benefited from public volunteer support. More effort is required to expand volunteer public involvement in these and other areas. I think I should point out that we should not be considering that kind of thing unless there is some reasonable return to the resource. The best example I know of an effective private initiative in support of wildlife and fisheries is Ducks Unlimited. Their success is due to the commitment and dedication of duck hunters to preserve wetlands but the benefactors include a wide range of users including non-hunters and a wide range of wildlife that has no direct relationship to ducks. I think we must never lose sight of the fact that fish and wildlife resources will get exactly the recognition and place on the land that the public deems they deserve. This will only occur if the public is sufficiently informed, involved and consulted on all matters relating to fish and wildlife management. The future of fish and wildlife in any jurisdiction, Alberta included, is directly dependent upon the political process. That political process deems that unless people understand that fish and wildlife interests exist out there and issues exist, we cannot expect decisions in policy on the use of land and water to positively affect those resources. It is the philosophy of people and their aesthetic and moral values that are the fibre of land use planning. Economics and economic values, although important, will apply more and more, mainly in determining the least costly ways of obtaining the desired lifestyle. Historically, civilizations have always been judged on how responsibly they have used and can serve their land and water. We, as well, will also be judged in a similar fashion.

My seventh point involves understanding the public user of fish and wildlife resources. One of the major voids of information in the area of fish and wildlife management is the public that appreciates and benefits from its use. Now there are some reasons for this. As resource managers, all of us have passed through our academic careers of focusing on fish and wildlife. From my standpoint, I thought that meant if you liked to fish and hunt that this was the way you should go. The fact is, though, that in going through these academic careers we have evolved to consider the elk as the client. And in fact, the elk although certainly clearly of interest to us is not the client. The client is the taxpayer. Unless somehow we can interpret that in a way that is supportive and understood by the taxpayer, we will always come out second in decisions relating to land uses and how they affect elk. It is of no use whatsoever to take an ecological argument for elk into a political forum. I can't emphasize that more. We have not done well in that area. Now we must put greater effort into understanding our public user clients, whether that range of understanding include such things as their general interests and attitudes toward fish and wildlife. All too often, decisions are made on fish and wildlife resources with little or no appreciation of the user client. And I might add that on occasion we have actually sent messages to clients that made them mad at us because we didn't understand who they were. So how we deal with the public and their interests has fundamentally got to be based upon an understanding of who they are and what their interests are. The corollary of this of course is that the public will not be able to make reasonable political decisions if they are not factually informed. On occasion, fact may be cast aside in favour of ill-informed emotion. A young lady from an organization that's active in Alberta, and in fact North America, stepped forward at a recent meeting that I was at and stated that fish jump because they're happy. She seriously believed that fish jump solely because they are emotionally showing us that they are happy. My point is that we have a great deal of work in an educational sense to even communicate the fundamental knowledge we have about our ecosystems.

In many of the more recent public attitude surveys I think it is clear that hunters are a minority, and that non-consumptive use is a majority. Many of these clients of ours are non-committed in terms of being anti-hunting, they accept it and leave it at that. But I should point out that the greatest efforts we've made in Alberta over the last few years, was to increase the qualifications of the hunter. We now probably have the best hunter training program in North America. My point here is that we should be very careful not to lose sight of the fact that unless we start to do something with the people that do not hunt even our best-trained hunters in this province may not have any place to go. So this is a very important area to address. I think that as a priority, public education is one area that we must deal with in a serious way if we hope to succeed.

My last point relates to professionalism and just because it's last, by all means do not think that is is least in terms of significance. At no time has there been a more pressing need to secure some form of professional status for biologists. All too often I am exposed to a wide range of professional standards. This range includes standards that achieve excellence to absolutely unobjective emotion. The biological sciences, particularly as they apply to fish and wildlife management, are still in a somewhat confusing state. Organizations such as ASPB have made significant and much needed strides in seeking professionalism in this field. The longer that professional status in this area remains unachieved, the longer the discipline will remain in a weak position. Toward this end I urge that the ASPB continue its initiative in Alberta to ultimately secure and enforce the professional standards it has been pursuing over years. Achieving this status will aid greatly in getting the credibility that the biological disciplines so desperately need.

I really thank you for the opportunity to speak here today. I hope what I've said has been taken in a constructive and positive vein. I have said these things because I believe in fish

and wildlife as a resource and their future in this province and in this country.

Thank you very mucn.

STATUS OF CURRENT AND FUTURE USES OF FISH AND WILDLIFE

DR. PAUL PAETKAU
RESEARCH UNIT SUPERVISOR
FISH AND WILDLIFE DIVISION
ALBERTA ENERGY AND NATURAL RESOURCES

The topic that was given to me is the Status of "Current and Future Uses of Fish and Wildlife" in Alberta. Everything we know about the future and current uses has been put in this little book. We've been criticized, actually been praised for certain things. I don't really wish to repeat some of that. I'll mention a little bit about the current and future uses but I thought I would go back in the past first.

Let's go way back to the beginning of time and we Europeans, of course, measure time as a time when we arrived here. Nothing happened on this continent until we got here of course. I think that the people who were living here at the time were basically the hunting society at that time and they probably used fish and wildlife for living, as food, subsistence.

I think that society didn't really make too much use of the fish and wildlife resource until the horse was introduced and then I believe the hunting society became considerably more efficient. I can probably imagine that at the time when fish and wildlife populations started declining, the local reaction was probably the first conservation organization to determine if the decline was due to habitat destruction or overuse of the resource. Did you know that fish and wildlife really was the basis for the formation of this great country Canada. We, of course, are based upon fur trade. I took a little bit of history from a book called "The Canadians" published, of course, by an American firm. I'd like to quote a little bit out of that book.

> In 1535, when Cartier discovered the broad Saint Lawrence he thought he had found the mythical waterway leading to China and he sailed eagerly west hoping to emerge in the Pacific Ocean. Then to sail across it and make a fortune in the fabulous China trade. Cartier's men put ashore 550 miles upstream visiting an Indian village on the site of the future town of Montreal. But just beyond the Saint Lawrence was blocked by formidable rapids. Undismayed by his bad luck, Cartier began trading with the local Indians, who in their eagerness for French knives and cattles offered him everything they possessed including the beaver pelts off their backs.

Well, back in Europe these acquisitions stirred a sensation among hat makers who found the skins ideal for making felt. The demand was so great that French traders in the New World recruited whole tribes of Indians as commercial hunters. So we have our first record of commercial hunters here. The Indians were such excellent harvesters that within a few decades the supply of beaver was gone in eastern Canada. And by the 17th century the future of the fur trade had shifted west. Thus the use of fish and wildlife had changed from subsistence to commodity. The whole way of life changed with that. The Indian people became traders, collectors of furs etc. Well you know the rest. Champlain, when he arrived in 1603, decided to go after the merchandise instead of waiting for it to arrive and the voyager was born.

The economy of the southern plains too was based upon the fish and wildlife resource. As late as 1857, Captain John Palliser reported that wide sections of this treeless plain was good for nothing but bison, since it was obvious that it could never support a large human population, apparently due to lack of firewood. The Metis of Manitoba had recognized this and established their settlement of about 10,000 souls on the basis of Quebec or river lots. Thus they had access to both water and fish. Then it would move through the wood lot, which is generally beside a river, so they had access to wood for the firewood and then it would go up

through the fertile fields for cultivation and then finally end up in what is still called the hay privilege, which is the prairie or the pasture on top. Bison in the Manitoba setting were of course a large part of this. Bison were really the reason for the existence of the Metis settlement in the Manitoba area and they had some interesting rules for their hunts. I'd like to read some of their game laws of 1840.

1) No buffalo to be run on the Sabbath.
2) No party to fork off, lag behind, or go before without permission.
3) No person or party to run buffalo before the general order.
4) Every Captain with his men in turn to patrol the camp and keep guard.
5) For the first offence against these laws, offender to have a saddle and bridle cut up.
6) For the second offence, the coat to be taken off the offenders back and be cut up.
7) For the third offence, the offender to be flogged.
8) Any person convicted of theft, even to the value of a sinu to be brought to the middle of the camp and the crier to call out his or her name three times adding the word "thief" at each time.

Well you know what happened next. Upper Canada could not stand the thought of anybody being happy without their consent and they still can't. And so they sent in the surveyors to cut these lots into square blocks. Andrew Knowl, a farmer, got mad at these young civil servants who suddenly appeared on his farm and started putting out little stakes without any prior notice and called for Louis Riel, who put down his foot and, of course, lost. Upper Canada sent in more British Orangemen to civilize these independent westerners and then got scared of the U.S. threat of taking over the

west and, horror of horrors, they opened the doors to the unwashed masses of Europe. As Clifford Siffton, Minister of the Interior in 1896, said "I think a peasant in a sheepskin coat born on the soil whose forefathers have farms for 10 generations with a stout wife and a half a dozen children is good quality for the west".

By 1911, the population of Canada's west had soared from a few thousand to more than a million. Well this is what happened about 1911. Settlers started moving in and the population went up quickly. The settlers also brought with them an attitude which still affects the use of fish and wildlife in Alberta today. Many a man who was squeezed out of Europe felt the pride and the lift of spirit of being secure on a farm where he could be in charge and no landlord and no government was going to tell him what he could do on his land. I think we still have many farmers like that who say get off here, I control the fish and wildlife on this land, so beat it.

I wish to continue the story now by going back to the records of the Fish and Wildlife Division. Starting back in 1905, Alberta became a province. In 1906 the Game Branch was put under the Department of Agriculture. Why do we manage wildlife today the way we do? Why do we have the uses the way they are? The problem of wildlife control in 1906 consisted of elimination of wolves and bounties were paid through the Western Stock Growers Association. In 1906 also, the Fish and Game Preservation Association was established in Calgary. The members assisted 218 voluntary game guardians. In 1907 we had 218 voluntary game guardians, with the senior position now referred to as Chief Game and Fire Guardian. In 1914, 148 fur farms had been established in Alberta, and fur farming was a big business in that time, using commercial fish to feed fur animals. In 1915, a demonstration train was organized with museum specimens that travelled throughout Alberta as an initial attempt to interest Albertans in their wildlife resource.

In 1918, we have public pressure showing up. Regulations were amended to allow trapping of beavers which had been a protected species until this time, but which were now a nuisance to farmers in

southern Alberta. In 1930, fisheries finally were transferred from Federal administration to Provincial administration under the Department of Lands and Mines. At this time, fisheries and wildlife were not in the same department. In 1931, mention was made of water pollution by sawmills, coal mines, oil wells, refineries and urban centres. Control was provided by the Petroleum and Natural Gas Section of the Department of Lands and Mines. By 1941, resident farmers were given the right to shoot birds without license but were restricted to particular areas. By 1944, under the fur regulations Indians were required to pay for trapping licenses. In 1945, a bag limit was imposed on ducks - 20 per day, 150 per season. By 1946, the Game Advisory Council now included representatives from the Alberta Fish and Game Association (4), University of Alberta (2), Provincial Fish and Game Department (3), Farmers (1), Indians (1), Fur Dealers (1). And finally in 1984-85, the Fish and Wildlife Advisory Council was reorganized to include 26 members representing a wide variety of interests, not including a number of civil servants who act as advisors to the Advisory Council.

This brings us to the present and the status of the Fish and Wildlife Resource which is really mainly the status of fish and wildlife resource for those species for which we give out licenses. The status of most of the other ones are not that well known.

What's left of the orginal uses? Remember the first use was subsistence. It is estimated that Treaty Indians who still have the historical legal right to gather food on crown lands and on other lands to which they have access, harvest a minimum of 1/2 million kilos of fish a year and 6,000 moose or elk a year. So that's what's left of subsistence with respect to fur trapping; there are about 3,000 registered trappers and about 10,000 recreational trappers. Anywhere from $5 to $10 million worth of fur a year is sold depending on the season and the price. Fur farms are pretty well all gone. And so the commercial fishing pressure is gone too that they exerted on certain certain species. But there are still about 2,000 licenced commercial fishermen, who harvest

just about one-half a million dollars worth of fish a year. Recreation is big business in Alberta. With 437,000 licenced sport fishermen in the province, they spend $300 million a year pursuing their recreation and this has been increasing rapidly. We have about 200,000 hunters and they spend about $200 million a year and that has been decreasing. The fishing licenses have been increasing at a faster rate than population growth while the hunting licenses have been decreasing with respect to population growth.

We don't really have too good of a handle on various uses and one of them is the viewing use. The national survey indicated that 80% of Albertans spend a lot of time (10-20 days) viewing wildlife. And they spend up to $300 million doing that. You can quibble with those figures but you know it is a reality. They spend a lot of money and there are a lot of people interested in viewing wildlife.

Now we should look at the future. We try to take a look at some of the future of certain species that are mentioned. All we can do to predict the future is take a look at the past. I think that the in future we will see 4 or 5 things happening. One will be increased emphasis on maintaining populations or remnant populations. That is increased emphasis on maintaining the inherent right of species to exist. As mentioned by Mr. Fields, we're going to have to be concentrating a lot more on the ecological unit or some unit that'll get away from simply looking at one species, by taking a look at all of them. I think there is going to be increased emphasis on recreational and aesthetic uses with viewing and probably non-consumptive fishing leading the way. I think there is going to be increased specialization. A lot more catch and release fishing will take place in streams, some select bird watching areas, big game viewing areas for tourists and on and on. I think there will be increased control whether we like it or not. As you have heard from Bob Fields, we will get more and more people who have a conflict of uses. Control becomes a necessity as to when one group can go out and when another one can't, in order to

allocate various uses. There will of course be increased competition for the public land that's available. Many of us consider the public land to be our land, but we're in a democratic system, and the public are going to tell us what they want done with that public land and we are simply the servants of the public and we will have to respond whatever way they tell us.

I see the role of the professional biologist changing in the future. Because of all this pressure I think we (especially we in government), will no longer be managers. We will be technical advisors. And we may be technical advisors to those people who control the land whether it be the Treaty Indians or some other group who may decide that they like to lease certain parts of Alberta. I think we'll be moving away from being the actual managers and we will be listening to the people who want to use the land and the people who control the land and they'll say to us "technical advisors tell us". And I think the one question we're all going to have to answer in the future is "Tell us how important is this piece of land for whatever purpose they want to use it". So I think as professional biologists our strength will lie in simply doing the best technical job that we can. We're biologists, let's be biologists and not try to pretend to be everything else and let's see how we can work toward answering that question. How important is this piece of land?

LUNCHEON ADDRESS
THE ANIMAL RIGHTS MOVEMENT - IMPLICATIONS FOR WILDLIFE MANAGEMENT

ALLAN HERSCOVICI

I am not a biologist, but I have some background in the fur industry. My grandfather came from Europe in the late 1890's, where he learned the fur trade. My grandfather established a small fur factory of his own and my father worked in that and so as a boy I was taken there on weekends, but I never went into the fur business.

When the ecology movement was growing during the 60's, I suppose that this mixture of some knowledge of the fur trade and having been in social sciences was one reason why I became interested in the anti-fur movement and why it was attacking the fur trade. And that is when I began to work on a radio series for CBC. I went across the country and interviewed a large number of people; all kinds of people--biologists, anthropologists, native leaders, trappers, and a lot of animal rights people. And that's when I began to learn about the animal rights movement. This was about 2 years ago, and at that time I really didn't know what it was. We all hear the name animal rights these days, but I think most people don't know that well what animal rights really is or what it represents. The animal rights movement basically is the idea that since Darwin at least showed that we are related to the animals, that we are one family with the animals, that there is one continuum, and we have no moral or philosophical right of any kind to treat animals in any way other than in a way you would treat another human being. So, it's not a question of humane killing, or managing a species or whatever, it's the idea that whatever you wouldn't do to a human being, you have no right to do to another animal. We have no right to use animals for our own purposes. That, in a nutshell, is the significance of animal rights, that animals too, have an intrinsic right, much as another human being,

and that we recognize the intrinsic rights of others to live.

The term animal rights as far as I can determine, was first used about 100 years ago by a man named Henry Salt, a social reformer in the U.S. who published a book called Animal Rights in 1894. This book apparently evolved from the animal welfare movement which developed in England, where in 1822, there was the first legislation passed in Parliament, to protect the animal welfare. The Martin Act, as it was called, was greeted in Parliament at first with hoots of laughter, and dealt specifically with the treatment of livestock to be slaughtered for food, or the treatment of horses that were used for transport at that time.

Perhaps one of the major abuses of animals at that time, was their use in transport. Development of the gasoline engine was really a major advance as far as animal welfare was concerned. The animal anti-vivisectionist movement, the concern about how animals are used in animal experimentation, also is very old.

As early as 1876, over 100 years ago, there was a Royal Commission in England, about the treatment of animals in animal experimentation, which is literally almost as soon as they were being used by the growth of modern scientific research. There also was a great dispute at Oxford University in the 1880's and people like Louis Carroll (Alice in Wonderland) was a very strong anti-vivisectionist. Oxford University had a strong anti-vivisectionist movement to not allow people into Oxford to do experiments on animals. Interestingly enough, Oxford today is still a very strong center of animal rights philosophy. A number of animal rights books were written by people at Oxford University. Stanley and Ross Godlivich published a book called "Animals, Men and Morals" in 1975. Peter Singer, whose name you may have heard by now wrote "Animal Liberation", which has really become the most popular Bible of the animal rights movement. Singer was at Oxford also at the time he wrote his book. Another person at Oxford at that time was Richard Ryder who wrote a book about animal experimentation called "The Victims of Science".

The history of the animal rights movement is something worth becoming aware of, and to understand what they're really talking about. The problem often is that you see various actions that either look ridiculous or misinformed, but it's rare that in the media there is any understanding of what this movement really is talking about. They really are not just talking about seals, or how seals are killed, and they are not just talking about how you kill furbearers, they are talking about the fact that you shouldn't kill any animals at all. It is important to understand the distinction. The sealing campaign began in the early 1960's with two concerns, as I see it. One was a concern about over-exploitation of the species, that too many harp seals were being killed, and the second concern was animal welfare. But, by 1972, both those concerns had really been dealt with by the Government and by animal welfare groups and industry. But you should notice that the biggest peak of the anti-sealing campaigns came four years later; 1976 was when Greenpeace first came into it. However, it was Brian Davies and his IFAW who had started it. Only in 1983 when, by which time international groups of scientists had confirmed that the Canadian management program was working, and NAFO (Northwest Atlantic Fisheries Organization) confirmed that the management program was working successfully that the herds were rising, did the European ban on the import of white coat pelts come into place.

So, what has happened is that really there has been a shift from concerns about animal welfare and ecology - two things that I think most everyone would agree with and think are important things - there has been a shift to animal rights. In this context, the basic idea is: "We don't care if there are too many being killed; we don't care if there are just enough being killed; we don't care how humanely you are killing them; we don't want you to kill seals at all." So, I think it is important to understand that animal rights simply is not concerned with ecology and animal welfare.

The important philosophy in the animal rights movement states: I am not just talking about human killing; I don't grant you

the right to kill me, even if you do it humanely, and therefore I don't grant you the right to kill animals either, even if you do it humanely. It's not just a question of doing it humanely, this philosophy states: I don't grant you the right to kill me even if you sneak up behind me and I don't even know it's coming and you kill me and I don't know. Further, I still don't grant you the right to kill me, and that morally and philosophically, there is no justification either for taking an animal's life. The one thing I'd like to make clear is that idea. But what are they really saying? If they are saying there should be no killing whatsoever, it's as if we should stop death. But the problem is, you know, that if there was no death in nature, all the available resources, whether it be water or oxygen or space, would be taken up in a very short time and there has to be death for the cycle to continue. However, animal rights people say well, people shouldn't get involved because people know better and they shouldn't do it.

There is also a political element in all of these things at a practical level. Canada was very dependent on exports in sealing and so it was very easy to attack Canada from Europe

The further away you are from the actual control of the resource, the less people know about it and the less they care. And that's the danger now with the shift which is taking place in the fur industry. Now that sealing has been virtually wiped out in Canada, animal rights activists are rolling this momentum over into other issues, one of which is animal experimentation, but another issue increasingly is the fur trade in general and it will increasingly be that because it is extremely easy for them to attack, because like sealing, the fur industry in Canada also is very export oriented. A large part of Canadian furs go to Europe where people know nothing about it and it is very easy to classify it as a luxury item. Thus you have a whole inherent class idea that this is something that is unnecessary, something that is for vanity, for profit, and other bad things, and Canada again can be easily hit from far away. The fact that trapping is of importance to many

native people in Canada (up to 50% of the trappers being aboriginal people) is not understood in Europe. The banning of sealskin imports into Europe has had a drastic effect on communities in the north of Canada and in Inuit hunting communities and in Newfoundland communities.

At the Royal Commission hearings in Montreal two months ago, Inuit people were testifying that in many northern communities which 10 years ago were virtually self-sufficient, the dependence on welfare now is tremendous. People don't have the cash to pay for the gasoline, ammunition and other things they need; repair parts for skidoos and so on, to go out and hunt for their food. That story hasn't come through. The question was asked by the Canadian media as to why we have a Royal Commission? The answer is of course that the impact of what the media have done is only happening now, but it is happening far away where nobody has to see it. As the Inuit people were testifying in Montreal, with virtually no ability to earn money, their entire cash basis has been wiped out.

Now the northern people have no choice but to go along with faster industrial expansion into the north where the habitat is often very fragile. Even the movement of ships through the channels breaking up the ice can have far more effect on the ecology of seals than the hunters can ever have. So, what really has happened? One of the things that has happened is that the media have really changed a lot of the rules of the game. These protectors, these animal rights groups have learned that media could be fed. They know that it is sensational to spray seals and to break into a laboratory, and guarantees prime time on the TV news. But long explanations of wildlife biology or managing a species is not considered good news and is not good TV.

The animals that Greenpeace and other groups have used to lead their campaigns have been exactly the animals that people have come to know in the aquariums, because of the vision of animals that was produced in the aquariums through the 60's. It has been the whales, the seals and the sea lions. These are the animals that

have all been the focus for major movements to protect them and it is not by accident. So you see the forms that media manipulation can take. The IFAW which was the major instigator of the seal ban are the ones who pushed the fish boycott last year in England and tried to do it in the U.S., in an effort to ban sale of Canadian fish products. That threat as you know, was used to stop the seal hunt.

The animal rights groups are now developing their own communications media. They have computers set up now where they are able to identify who has given them money in the past, for what issues money has been given, to what type of issues people will respond, and then they can feed their mail orders. If you just send out a blanket mail to 100,000 people in an area, you will get a tiny response, but with computers, you can identify exactly who will respond to which issues in which areas and you can prepare your media materials accordingly. Thus, 5 million letters were sent to the European parliament saying "End the Canadian seal hunt", and that is what the Europeans did. That doesn't mean the majority of people are ready to end the seal hunt but the people they are hearing from are. I think everyone has been somewhat mislead by the ability of animal rights groups to manipulate media, and to get their message across.

Industry and government are very paranoid that these groups are so strong, and that is why there has been so much fumbling in trying to defend the way in which wildlife is managed in this country. And that is why I think most people know nothing about how wildlife is managed in this country. It is important to realize that probably the majority of Canadians do support and accept the use of wildlife as long as they are assured that two conditions are satisfied. They want to be confident that every effort is being made to monitor them and to know how they are being used and that they are not being over-exploited. And they want to know that every effort is being made, if we are talking about furbearers, to take them as humanely as possible. The Humane Trap Research Program that

is going on in Vegreville, near Edmonton, is the sort of thing that is very important. However, almost no public knowledge exists on this program.

Furbearers have been brought back in many areas over the last 30-40 years, and yes, there is a major Humane Trap Program; yes, there have been major changes; there is trapper education, there are a lot of things which have already happened and are happening; thanks to animal welfare groups. Let us not forget that animal welfare groups have done a lot of good in many areas. If they hadn't been pushing, a lot of things wouldn't have been done, or wouldn't have been done as quickly. I suppose you people realize too, that it helps scientists do things when there is that lobby behind pushing, so there has been a contribution; things have been done. The system is working. The system does respond, not perfectly, not completely, but it is responding and that is the message that has to start to get across. You have an important story to tell. You people know things that the public want to know and needs to know. I am hearing at this symposium that you are taking steps to do more public education, and I think that it is a very vital role that you have to undertake.

Animal rights organizations have a professional media attitude. They know they should always use the proven tactic of picking off the softer targets, one by one. And of course, after they have done that consistently for a few years, people will be brought to a higher consciousness, they will be supportive to the next greater steps towards ending all exploitation of animals. Obviously, Canadian sealing was a soft target. And the Canadian fur trade is a soft target, and it is going to continue to be a soft target until Canadians (and Canadian media) start to realize that they have been manipulated and that they have been taken for a ride concerning management of wildlife in this country. I don't think we have to be ashamed of anything, compared to any other country in the world, with respect to use of wild animals, but Canadians don't know that. And I think the first step is that Canadians have to start to

know and I think that groups like yours can do a lot to helping them know what has been done.

The RSPCA in England has now launched a major anti-fur campaign; the biggest campaign in their history, and Canada is identified as a target in that. Greenpeace in England has launched a major anti-fur campaign with the goal of ending fur use in England totally. England is one of the major Canadian fur markets. In the European Parliament now there is work going on to try to get a similar ban of furs in general. So, that's what is going on, and that's what you have to deal with. In conclusion, I think that groups like yours have a most important role to play. Animal welfare groups have accomplished a lot. As I said, they have forced improvements in many areas, and have also forced groups of fur producers, different groups that once were very isolated, to react. There have been groups like the Aboriginal Trappers Federation of Canada which have been formed, organizations which never existed before. There is a possibility now of a kind of communication between many different people. Let us move on to a leadership role, a real leadership role, let us not just talk about the fur industry being good for natives - let us do something about it. We must take an active role. I think that as scientists you people have a central role, because you know more than most about what we are really talking about here. And I think it is important that you find ways to get out and start to communicate with the public. The public is interested and they do want to know about what you are doing. I wish you good luck and I thank you for having me.

SESSION II

PUBLIC PERCEPTIONS OF
FISH AND WILDLIFE IN ALBERTA
PANEL DISCUSSION

CHAIRMAN: Dr. D.A. Birdsall

PANEL DISCUSSION

CHAIRMAN - Dr. D. A. Birdsall, LGL Limited

PARTICIPANTS - Sam Sinclair, Metis Association of Alberta
Ron Gladish, Alberta Fish and Game Association
Gerald Labrie, Alberta Trappers Association
Vivian Pharis, Alberta Wilderness Association
Neil Jennings, Trout Unlimited
Lorraine Allison, A Citizen's Point of View

Fish and Wildlife Division Respondents
Tom Mill, Ken Ambrock, Bill Hall

Dr. Birdsall:

I have taken the liberty of writing out some instructions to panel members and since the rules should be known to all, I'll read those instructions now. Since the purpose of this Symposium is to contribute to the quality of professional biology and not to criticize unconstructively, I would ask that each panel member keep this in mind. Legitimate criticism of fish and wildlife management must be accompanied by constructive solutions. Each panel member, and there are 9, will be allotted 6 minutes to discuss their perceptions of fish and wildlife management. Following this, each member will be allotted 3 minutes to respond to others, or to ask questions of others. Following this, questions will be solicited from the floor. So, each person here will get 2 shots and then we will go to the floor. When a panel member strays from the topic, to areas that are outside the domain of fish and wildlife management, I will interrupt. I will also interrupt at the end of each speaker's allotted time. I will also take the liberty of referring issues raised by one panel member to another panel member for comment.

The Alberta Fish and Wildlife staff who are panel members should feel free to ask questions of the public members during both of their allotted time periods. When criticism is made of the Alberta Fish and Wildlife Division, they should not respond defensively or argumentatively, but rather in a positive way that the criticism is intended. I trust that we shall have a lively and informative discussion.

Neil Jennings:

Thank you Mr. Chairman. My name is Neil Jennings and I've been invited here as a member of Trout Unlimited which is an international organization dedicated to the preservation, protection and enhancement of trout and their habitat. I also own a shop in Calgary which caters to fly fishermen and bird hunters. Some of my comments today reflect the positions of Trout Unlimited and some of my comments reflect my own personal views and some reflect the views donated by customers in my shop.

It is our view that the two most pressing concerns existing today for the users of wildlife resources in this province are loss of habitat for both fish and wildlife and failure on the part of the government to adequately address the problems associated with public access to resources which are owned by the public. I realize this conference is premised on fish and wildlife management practice in Alberta, but there is a paradox apparent to us. If we are correct in saying that loss of habitat and access to resources are the principal problems existing today in respect to users of fish and wildlife resources, these problems are not strictly speaking problems of management. They are really problems of politics. And being such, they cannot be adequately addressed by wildlife managers because such matters are not within the ambit of those managers.

We all know that fishing and hunting in Alberta is a big business. You hear numbers of 500 million dollars per annum being spent. At present the Fish and Wildlife Division estimates that 1 in 5 Albertans is an angler. There is every indication that that number is increasing. The growth and the interest in the sport of angling is unavoidable. It appears, however, ironic that while the growth is apparent, the reality is that there is a constant and apparently unrelenting pressure to destroy or denegrate many of the finest opportunities available in this province to enjoy the angling experience wished by many. The other irony in this situation is that destruction of the fisheries resource is not being caused by the fisheries managers themselves, but is being promoted wittingly

or unwittingly by politicians. There is a strong and widely held perception that fish and wildlife managers are constantly fighting a rear guard action to mitigate the damage to the resource which is being occasioned by politicians.

Trout is the preferred game fish in Alberta for most Albertans and most of those Albertans want to fish for trout in moving or flowing water environments. The flowing water trout resource is the most valuable and most desired by anglers. It is also the rarest trout resource in this province and in its preparations for the South Saskatchewan River Basin hearing, the Department of Environment identified 3 stretches of moving water in that Basin which are most used by anglers. One was the Red Deer River, between Sundry and Red Deer. The second was the Bow River between Calgary and the Blackfoot Indian Reserve. The third was the Old Man River above Brocket.

Moving waters seem to be on the political hit list in this province and this perception is suported by review of recent history. A review of recent water management decisions will show even a casual observer that the Red Deer River now has a dam on the stretch that is mentioned. The Old Man River and two of its tributaries, the Castle and the Crows Nest, will be inundated by the announced Three Rivers Dam, which is to commence construction next year and there are persistent rumours of another dam to be constructed on the Bow River in the stretches below Calgary. These rumours of a dam on the Bow River are consistently denied by government, but quite frankly the angling community which makes use of those portions of the river for angling do not believe such denials. The track record of the government with respect to dams does not engender any credibility as relates to such denials. In our view, the major dams in our trout streams present probably the greatest threat to the stream fisheries. They inundate the very productive trout water, they rob the angler of recreation, they are terribly expensive to the public, their detrimental effect on the fisheries are irreversible and they are in almost every case in this

province, the precursor to a dewatering of the stream in favor of irrigation practices which are expensive beyond any possible economic justification and are embarrasingly inefficient.

The government's announcement of the construction of a dam on the Old Man River at the Three River site was met with widespread rage and indignation by the angling community familiar with those waters. We are told by government that we will have new recreational potential provided by the lakes formed behind these dams, but that as they say in Newfoundland, is being some careless with the truth. Most of these impoundments are being built to serve as irrigation reservoirs, and as such will be subject to drawdown to satisfy the irrigators' demands for water. Given the drawdown, the littoral zone in those lakes will be consistently destroyed and we see no long term possibilities for angling or any other recreational opportunities in the reservoir. This is particularly the case of the Three Rivers Dam. We see consistent wave action generated by the pervailing winds acting on mud flats, such that there won't be any recreational potential behind that dam. The apparent attitude to fact on the part of the government is unfortunately strained. Many anglers prefer to fish free-flowing waters, not lakes. It makes good economic sense, too, because all of those rivers in question are quite productive of fish as a renewable resource through natural propogation, whereas any reservoir would require stocking programs for trout in order to contemplate a trout fishery. Such stocking programs are very expensive and indeed, they are not what many anglers wish in terms of their angling experience. Still-water angling has a place in this province, but we do not need to dam our rivers in order to provide for more lakes.

The significant losses experienced in terms of moving-water fisheries are a grave concern to many anglers in the province, but I said at the outset we don't view this as a management problem, it's a political problem. I cannot conceive of any fisheries manager sitting in this room, or any fisheries manager in my wildest imaginings who would come up with, conceive and build a dam on the

Old Man River at the Three River site. I can even less conceive of any fisheries manager who would do so on the lower Bow River. I fully believe that Diogenese would have an easier time finding an honest man, than he will finding a fisheries manager who would propose such things. As the future strategy, we have the Dixon Dam, we are apparently going to be visited with a Three Rivers Dam. It occurs to me that the objective of Fish and Wildlife and the Department of Environment should be to attempt to build tailwater fisheries in those rivers, such that at least the fishery in the moving water in part could be replaced, in terms of free flowing fishery.

Lorraine Allison:

On the program today I'm listed to present a citizen's point of view and the citizen that I am choosing to be is the private land owner. Those of you who know my biologist personna are asked not to make judgments about professional objectivity based on what I say today, from the rancher's perspective. Since I wasn't asked to be objective, I have no intention of being so.

The other evening I was reading some of the exploits of Smith, hero of the Chilkotans in Canadian fiction that some of you may know. Smith recognizes that the ranchers are an elite class who enjoy a way of life that is unappreciated by doctors, lawyers and other lesser mortals like biologists. And many of the characteristics which made Smith both endearing and exasperating to his readers are shared by many cattlemen, I have to admit, today, and riding across the hills still seems to many of us to be a very romantic occupation. Inevitably, however, all of us have to come home and talk to our bankers and it is clear that the maintenance of the ranchers lifestyle requires economic solvency.

Much of the production of wildlife in this province occurs on privately held land and, as a society, we do not seem to appreciate the role that private landowners have played and continue

to play, in maintaining the wildlife resource and the ecosystems on which they depend. We hear a lot more about ecosystems lost because of agriculture than we do about those in which good management by government and landowners allow the coexistence of both wildlife and agriculture pursuits.

Generally, the Fish and Wildlife Division trys to work with landowners to deal with problem areas, but solutions are often lacking. The kinds of problems that demand solution and because they have economic consequences that are quite large, are wildlife resident on range land, winter and summer, annual forages and in stack yards by large groups of elk, decimation of annual forages by deer or bear, controlling the activities of beavers and dealing with predation. They're all familiar with waterfowl problems as well. I have to emphasize that many land owners are generous in their approach to wildlife and that their problems seem to have to represent real and, to my mind at least, relatively large economic costs before serious complaints occur. To use elk as an example, on a year-round basis each elk probably costs the rancher approximately two thirds of a cow. And if they get into stacked hay, the cost is much higher. Now that doesn't seem like much perhaps, but 100 fewer elk translates into 65 more calves per year. And this year, feeding 100 head of elk could cost you 150 dollars a day. Problems tend to be dealt with by attempting to regulate the hunt. In the Pincher Creek/Waterton/Old Man area that I am most familiar with, cervid numbers are very high, thanks in part to low harvest, high winter survival and high recruitment.

Affected landowners would like to see changes in the regulations and have been invited to present their views to the Fish and Wildlife Division. Recommendations will include realignment of certain zone boundaries, to make sure the hunters get to the right place, changing doe and cow tags to eliminate the taking of males. It is now optional, if you have a doe tag, you can take a buck. Elimination, or changes in the draw system to ensure that the harvest of problem herds will occur, development of better and more

accessible wildlife damage and hunter damage compensation programs, deciding in advance how a severe winter will be handled. The idea of intercept feeding I personally don't find too attractive, but I see it is on the program so I am prepared to hear why it is. Finally, I would like to see a program encouraging the production of a variety of wildlife on private lands. I'll expand on this final one a little because I think that there have been some excellent programs proposed that haven't received the kind of results that they should have, partly because of some of the problems that landowners see in them, such as public access being associated with the program. The program is not being well enough publicized to be available even to a mildly interested landowner. Such programs have to be on a large scale. Placing unnecessary restrictions on the landowner or including caveats on the land possibly unnecessarily alienates the landowner by the way in which they are presented. Hunters, I will just mention briefly, and only to say that people are a major problem to landowners. I personally am angered every year to be observed through the scope of somebody's rifle, to have somebody shooting towards my house and to have someone take for granted his right to drive over my gates, cut my fences or drive his 4 x 4 in country where I take a saddle horse only. We appreciate the trespass provisions of the new wildlife act, but we believe they should have included both Crown-leased and deeded land.

Ron Gladish:

First of all, I wanted to talk about the structure of the Fish and Game Association for those of you who don't know. We are an organization with about 24,000 members in 125 affiliated clubs across the province. We are fortunate in that our membership consists of just about every walk of life in the province. We have doctors, lawyers, accountants, scientists, laborers, farmers, ranchers. Basically, if there is an occupation or a walk of life, they're in our organization. From that broad membership base, we

are able to get a pretty good sample of public opinion. Our association annually has a meeting and we present about 20 resolutions to government following the meeting. When that procedure is started at the club level, we usually start with about 60 resolutions and of those, 50 are concerned with fish and wildlife management in Alberta. And 40 of those are directly concerned with hunting and fishing seasons. So, as you can see, there is a lot of concern about how wildlife is managed in our association.

As far as public perception of fish and wildlife management is concerned, I'm not too sure that the general public even knows what wildlife management means. I'm not even sure if they care. I can tell you what our association perceives as part of the public. If you follow the media, it is plain to see that everyone is a wildlife expert. Unfortunately, all of these experts look at wildlife through their own window. To use some examples, the preservationist looks at a live animal in a carefree and kind world. The media see a story or an article. The landowner sees competition for his operation. The politician sees what his noisiest constituents want him to see. The bureaucrat sees the easiest way to deal with the management problems. The fisher and the hunter sees a resource that's diminishing. The developer sees wildlife as a development cost and industry generally sees wildlife as an obstruction. With all these experts and their opinions it is not surprising that government is getting mixed signals all the time. And the public, when they look at all these experts, wonder who is in charge of wildlife.

Lately, wildlife has been shown to be such a valuable commodity that everyone wants a piece of the action. For example, consider game ranching, or paid hunting. Some of the public even feel that government is selling out. To follow media reports on wildlife in Alberta, it looks like the government method of managing fish and wildlife is akin to Nero fiddling while Rome is burning. We all know that that's not true. But why is no one telling the public what is being done? The government has done an excellent job

with the status reports on fish and wildlife. Now that the document has been developed, it must be presented to the public so that they may understand it. And more, why is the government not collecting all these expert opinions that are available and looking at management on a provincial scale and sticking to their policies, and I'll use an example, which has already been used twice - elk management, in the foothills. When seasons are set there are a lot of criteria and one of them is interfaced with agriculture. Most ranchers do not want hunters in the foothills, in the allotments, while the cattle are there. The cattle graze in the grazing allotments all summer and all fall. This year we have a situation where the cattle moved down early and those same ranchers who didn't want hunters out early in the season to keep the numbers down demanded a special season to cover the problem. Sooner or later somebody will have to say what is good for the elk, not just what is good for each individual.

The final thing that I wanted to talk about is the public not getting enough information from the scientific community. If research scientists do not start presenting information gathered in terms that the public can understand, we don't need them. That's right. We don't need the studies or the scientist if we cannot learn from them. Some of the public believes that research is written intentionally so that it is not understood. Your challenge is to prove that that is not true. Scientists must get public support for wildlife management and we must understand what we have to support. So, to sum up, the public perception of fish and wildlife management - government is selling out to the highest bidder; groups with narrow scope are getting press as wildlife experts; no one is looking at the total picture of wildlife in Alberta and the scientists in fish and wildlife management are losing support because they are not understood.

Thank you.

Sam Sinclair:

It's an honour to be invited to this conference because this is one of our ways of communication that we want to deal with on our stand on our constitutional rights. I'd like to touch a little on that because it relates to fish and game management. Right now we are right in the centre of negotiating with both governments on the rights of aboriginal people. And for people who are not aware of what can happen in the next few months, or next few years, is when people under the Constitution get their Indian rights back, there will be an influx of new treaty Indians that weren't there before. But, when we are talking about aboriginal positions, it was only in 1982 when our aboriginal position as Metis people was inserted in the Act. So, now they are dealing with us jointly as all aboriginal people, which is Indian, Inuit and the Metis.

With that in mind, our two main topics with government that we are dealing with right now are land base and self-government. Now, please understand, ladies and gentlemen, when we talk about self-government, we are not talking about a third order of government. We are not trying to take over what you have now, or what you perceive to have. We are trying to get unoccupied lands, mainly in Northern Alberta, which you people call the green zone, we call it native land. However, if we have land set aside for our people, we must look at economics. When we talk about self-government, we have to be the decision-makers in what happens to the resources from those lands, we need a percentage of resource money to govern those lands. Without going any further on that, I would ask you people to consider how it relates to fish and wildlife management.

Somebody mentioned earlier at the luncheon that we have 50 percent of our trappers who are aboriginal people. In some places it is 100 percent. But overall, I guess it's between 50 and 60 percent. Greenpeace definitely affects us, but I'll leave that aside for now. If we get hunting rights for our aboriginal people who haven't got rights now, that is, people like myself, who is

roughly 7/8 Indian, there must be some new laws made to preserve the game that is out there now. And if we are given the chance to accept responsibility to govern that resource, we certainly want to be part of that. And when we look at some areas where the population is 90 - 95 percent native people, they should definitely govern that area of fish and wildlife concerns. Maybe if we have our fish and game officers as aboriginals out there, governing the fish and wildlife resource and obtaining the revenue that ordinarily goes into your general coffers, we might be a lot stricter than you people think to save that resource.

However, the seriousness behind this whole thing is that the game has always been up in the north for food for every day for our people, and that has slowly been taken away from them, not intentionally maybe, but by oil companies you have heard so much about, as for instance, in areas like Lubicon Lake which we dealt with yesterday. Those kind of things the general public doesn't realize how much damage is being caused to people that have to live in that kind of environment. We can sit back and holler and say the white man is walking all over us. I'm tired of our own people hollering. Being a leader, I say let's fight for our responsible positions in solving this together. This is an issue for all people and for our government to recognize and to give us a share of the action to solve these problems that are out there. If we are part of the solution, by having management responsibilities, we certainly can't only blame the white man all the time for making wrong decisions. I'd like also to touch a bit on, environmental controls of areas where heavy pollution occurs. That again relates to fish and wildlife because you people are called in when it relates to killing of fish such as Fort McKay, which was highly publicized as a result of pollution of the Athabasca River. So, again, if we are given the resources to work with, we certainly want to work with you on those kinds of problems.

The Greenpeace movement is really affecting our people. I'm on the committee that is dealing with international affairs. I

sent some people last week to our Canadian London Embassy to deal with a small portion of the issue, and who will be going later to 6 different countries to speak on how it affects the livelihood of native people. If we don't do something now, and once we are walked on, again, it will be too late. I believe that a certain amount of people sympathize with us on the way organizations like Greenpeace hurt our people and I think we need your help to solve that kind of problem.

Thank you.

Gerald Labrie:

The Alberta Trappers Association feels that current fish and wildlife practices in the province of Alberta may be in need of a change. Fish and wildlife resources of Alberta have received a great deal of pressure over the last decade. We question if the people responsible for the management and care of this resource ever expected such a drastic change in the loss of habitat along with the heavy utilization that has taken place. Opinions have it that inadequate land and water management has caused the greatest losses through the destruction of valuable wild land and clean water respectively. Valuable wildlife habitat is being destroyed every day by all the industrial development that is taking place in this province.

Along with the extensive industrial use, we must also contend with the large tracts of land that have been cleared for grazing reserves and other agricultural development. Another item of concern is the implementation of the integrated land management plans of which there are several in the province. It is the opinion of the Alberta Trappers Association that most of the land designated in the integrated management plan is very marginal for agricultural use and would be best left as wild land for wildlife habitat. We base these opinions on the fact that there is land that lies adjacent to some of these management areas, which is marginal land

for agriculture and people have not been able to successfully make a living from agriculture. We question the feasibility of creating more of these unfavorable situations. Leaving this land for wildlife habitat should receive a much higher priority than it has in the past.

As mentioned earlier, with the extensive new development that takes place in the forested areas of this province, we lose valuable habitat every day. Along with these activities comes the creation of new access to the areas where there never used to be any, and consequently more competition occurs for the wildlife in these areas. We in the Trappers Association feel that proper land management should be the first priority, and that careful design regarding access be considered with all new developments and other activities that take place.

Over the years, the Fish and Wildlife Division has carried out a number of extensive studies in both fisheries and wildlife. The data gathered and the information put together as a result of these studies must surely be of some benefit when managing these resources. It is our hope that when these studies are carried out, that the resource itself is the major concern for the study being conducted and not for other reasons. We also feel we must concern ourselves with the fact that there have been extensive studies carried out on a particular species of fish and wildlife and a lot of good information gathered and documented. As a result, recommendations were made, based on the information gathered to make a change where there was a concern regarding a particular species. These recommendations were well received by people who are directly involved with the utilization of the resource and support the recommendations. It was felt that something had to be done if the species was to benefit. Unfortunately, these recommendations for a change were not carried out. We would like to point out that when these types of studies are carried out and the facts are presented and can be backed up by supporting data, that these recommendations should receive full support of government. It is very unfortunate

when these types of things go by the wayside or are shelved as a result of interference from some groups who do not put the concern of the resource first, but think only of themselves. It is imperative that the resource itself should get first consideration. These types of things have happened in the past, and there is no doubt it is the resource that suffers. Having seen the changes that have taken place over the last 20 years, has enabled us to appreciate the many problems that go along with responsibility of management of renewable resources. We can only hope that what has been done up to this point in time has been the right thing for the resource.

Relating to the wild fur industry, we feel that there is a definite need to change the management techniques and practises that have been with us since the birth of registered trap lines and trapping areas in the province. With the design of a new wildlife act and wild fur regulations, it is hoped that a much better system regarding proper utilization will be adopted and put into practice. It is necessary that we keep in mind the future needs and not only think of today, but incorporate the concerns for tomorrow in our planning and management. We in the Trappers Association see one very big problem for the people who are directly responsible for managing our wildlife resources. It is our contention that in order to properly manage a resource, one must know what numbers one is dealing with. In the province of Alberta there is a significantly unknown number that has to be considered and that is the number of animals taken by treaty Indians. It is our opinion that if the resource is to be managed properly, there has to be some way of getting accurate information as to what portion of the total is taken by native people. This concern seems to be one that everyone is willing to shy away from and no one seems to want to get involved. With the pressures that are placed on the resource, we feel there is a definite need to design some means of getting accurate information regarding the Indian take, if the resource is going to survive. Possibly some type of compulsory registration

could be implemented or the numbers regulated as to need. It is very important that something be done to deal with this problem.

It is recognized that all the problems related to fisheries and wildlife management are not easily solved. We feel that public input of opinions through representatives from different interest groups is a way for getting the public involved. We in the Trappers Association certainly appreciate the opportunity to bring the matters that concern us to the attention of those who make the final decision. Public information and education are also very important when it comes to informing the general public. Continued conservation programs, such as the Alberta Hunter Training Course, Alberta Trapper Education, along with other wildlife related subjects are very important. We feel better communication between government departments is essential so that everyone who has an interest will have a better appreciation for the other through better information exchange. There are times when things get hung up and progress is very slow and people must learn to be very patient. Unfortunately, there are some government departments that seem to have so much more political strength and their interference sometimes causes things that were planned not to materialize. The resource is always put in the proper perspective when critical decisions are made which affect it. We may win the war.

Thank you.

Vivian Pharis:

The Alberta Wilderness Association (AWA) is an organization that carefully scrutinizes the activities and directions of the Fish and Wildlife Division. As Canadians, especially western Canadians, we are very involved with wildlife, both on a consumptive and a non-consumptive basis. The AWA, which has about 2500 members throughout the world, mostly in Alberta, was founded by sheep hunters, concerned with sheep habitat disappearing along the eastern slopes during the 50's and 60's. The Association was conceived as a

hunter-based organization primarily interested in ensuring habitat for wilderness dependent species, as well as to have wilderness set aside for man's recreation needs. The Association is now at least evenly composed of consumptive and non-consumptive users with probably the non-consumptive users increasing in our membership.

Regardless of how we use wildlife, a primary concern of our Association is for wildlife habitat. Access to and the use of public lands, wilderness retention, are adjuncts of this concern. We want to see the conservation (the wise use, in other words) of the wilderness and the wildlife resource continue and be improved in the province. The AWA is very supportive and protective of the Fish and Wildlife Division. I think we see this division of public lands and wildlife as the government agency nearest and dearest to our Association and we feel public allegiance to it and its work and we tend as an association to be both supportive and protective of its programs. By supportive of the division, I mean that of what the division stands for and what its broad and historic goals are as well as part of the division that is at work on the ground in particular.

We tend to become alarmed and we tend as an Association to go into spouts of criticism at times when we perceive threats to good wildlife management programs that are in existence, and redirection away from good wildlife management in the province. For example, we are concerned about budget cutbacks now. We regret very much the low number of officers in the field being maintained at unacceptable numbers in the face of increased pressures and demands for their services. We likewise are dismayed by the curtailing of research, and the virtual disappearance of long-term research within the division, except for crisis research. The fact that some research is being contracted out or assumed by the new environment centre seems inadequate to us, and too far away from those who are charged with overseeing our wildlife. The public is keenly interested in wildlife research. We like to know that our wildlife agency is participating if not being on the cutting edge.

We do see encouraging directions within fish and wildlife. A policy, for example, has been developed and accepted and, despite its limitations, it will focus the division. A status report which came out this year, despite its limitations, has long range goals established and it will provide valuable information for the public. And this is for the public, I think, to continue supporting the agency. There is re-emphasis apparent within the division to finally focus on wildlife habitat and this we all recognize as the crux in maintaining wildlife and we applaud this. Other threats that we see to the division are of great concern to AWA, for instance, the dominance of other departments over the Fish and Wildlife Division. Traditionally agriculture and forestry, for example, have dominated the division and despite the fact that it is now being shown that the cattle, forestry, tourism and wildlife industries each contribute about the same amount to the economy, these other, older, more established departments still tend to dominate fish and wildlife. They dominate in terms of staff numbers, in terms of budgets, and in terms of their stature in government.

We regret political manipulation to the detriment of wildlife, and short term political decisions that are always being imposed on the wildlife division, often forcing wildlife programs that need long term or broad management to be curtailed or changed in directions, which often is to the detriment of wildlife. For example, game ranching, which is diametrically opposed to good game management, could only be a politically inspired concept. Another example is the reintroduction of fall grizzly hunts, instead of dealing with local issues, by local management people in fish and wildlife. Instead, we open season on the grizzly in the fall. A third example is the decision to simplify game zones or in the new government jargon, to deregulate, so that the zones are no longer management units based on population or ecological boundaries. We think that this is a regressive step and is politically inspired. A fourth example is the elk depredation programs, which could severely

jeopardize the future of this animal in parts of the province. Instead, we should be buying back critical winter range. If such range now is private land, we should be reducing cattle on range critical to elk, and we should be redoubling our efforts to help farmers guard their winter feed supplies and fields.

We feel that increases in hunting licences are essential, since they are really too cheap now. I am a hunter, but I'd happily pay 5 times my hunting license, or more. We think the government should institute a whole new range of innovative fund-raising programs for wildlife habitat. We also feel that the Fish and Wildlife Division should be really looking hard at new public relations efforts, and we've been hearing this today over and over. More emphasis is needed on educating the public about what the Division is doing, about the importance of wildlife, about the importance of the role of hunters in game management. If we don't have hunting, we are going to be in trouble managing our game. A much more aggressive program of public relations is essential and could be an excellent promotion for the government in the long run as well as educating the public in wildlife. The public is really interested if you take a look at the number of wildlife films, for example, on TV programs. People are really hungry for information. And if they are given the right information, they begin to understand the difference between animals, as the animal rights groups see them, and animals as part of life, part of the whole environment.

Thank you.

Tom Mill:

We came here thinking we were responding to the perceptions as presented by the other panel members, but not to present our views, so I am going to try to combine those two things, by making some comments on public perception as I see it, based on things that I noted down here while the other members of the panel were

talking. The first thing I should say is that I agree with everything that everybody else said and I wish I could always be as free in my role as a public servant to say some of the things in quite the same way that my colleagues here at this table are able to say them. I'll follow up by repeating something that Mr. Surrendi said this morning. Mr. Surrendi said that the public will ultimately get what it wants and I think that in a general way he is correct. I hope also that it is correct in the longer term, broad perspective of wildlife and fisheries management in the province. Thinking about what Ron Gladish said about scientists, in the government sector, not being clear about what they are talking about, or not being convincing, I feel that there is a public perception in fish and wildlife management, that it is not our job, as public servants, to tell you what to think or to package information in a way to convince you of one side or another of the argument. I don't believe this is correct. I think there is a misconception amongst the public that that is our job. I think it is our job as biologists, and as managers of public resources, to try and be accurate and factual and as honest as we possibly can be. I think then that it is our job as citizens or as professionals in fish and wildlife management, as professional biologists, to put the public in the position to achieve those things that they think are best, and then communicate to the political level of government what they want.

Thinking a little about what Vivian Pharis has said, there is the necessity not to spoil your currency, as public groups. I think there is a requirement to be selective. And I think there is also a requirement to carefully control the stridency of your debate and particularly to not point the finger at individuals among the public service. That is a personal comment perhaps, on public perception of fish and wildlife managers, rather than fish and wildlife management. Finally, I want to throw out a little bit of a controversy in that not all of the so-called loss of fish and wildlife resources and opportunities is a function of habitat loss

or change. I think a good portion of it is simply that we use too much of the resource in a consumptive way; we don't put it back. From my viewpoint in fisheries management that is perhaps something you will see and have been seeing, people in the public and myself on behalf of fisheries management in the government sector, suggesting that we should take a look at changing our perception of fisheries management.

Thank you.

Ken Ambrock:

In quite a positive way, in keeping with the theme of the panel session this afternoon, I feel that we are in a very positive forum here, where we can exchange ideas and hopefully get some benefit out of it. And I don't mean that in a negative sense at all. Quite clearly from my standpoint, in listening to the discussion this afternoon, I tried to listen in terms of hearing suggestions for how we might improve the quality and standards by which we manage resources in Alberta. Quite clearly also there were some very good suggestions.

In any event, from a habitat point of view, I think that it should be clearly understood in promoting the quality and standards of the professional habitat protection biologist, whether he is on the protection side or on the development side is quite clearly not a specialist like a fisheries research manager, or a wildlife research manager. He is the jack of all trades that goes out there and does a number of things in terms of trying to manage land use for the benefit of both the fisheries and wildlife resources. He is charged with the responsibility almost invariably of dealing with land use conflicts in various forms and maybe this panel itself is a reflection of the kinds of things and groups that he has to deal with.

As Tom Mill said earlier, maybe we should make reference to what was said this morning because there were some important

messages that came through both from Mr. Surrendi and Mr. Fields. If I have this quote right, Mr. Fields said: "We have to be flexible in dealing with biological, social and cultural issues." My perception is that we have to get back to habitat biology, which I feel very strongly is not a precise science. We have to combine public needs with what we think are best guesses in terms of protecting fish and wildlife resources. Just to illustrate a point, we have a strong rancher and irrigation farmer lobby in the province; we have several thousand treaty and non-treaty Indians; we have 90,000 sport hunters; we have 350,000 licensed sport fishermen; we have 3,000 registered trappers; we have 1,500 commercial fishermen. We have members of lobby groups, including Alberta Fish and Game Association of over 20,000 people. We have naturalist and non-consumers whom we know are spending a lot of money out there, but we are not sure how many of them there are. We have the AWA which is in its infancy stage in that I believe it has a membership of about 700 now in Alberta. So, when we look at that and ask our habitat biologists to try and make trade-offs in terms of what is best for the resource and the people, it is a very difficult task they are charged with. Therefore, I would take exception with the comments of Ron Gladish that the bureaucrat looks for the easiest way out.

I would like now to discuss some of the specifics in terms of some of the excellent points that were raised during this panel discussion. We have heard of the loss of habitat and we all seem to have that concern. The Alberta government is focusing very heavily its efforts on habitat retention within the settled areas of the province and we have initiated a fairly pro-active program to go out and acquire lands, or lease them, or take out easements on lands which we felt were valuable habitats. A point that was made in the discussion this morning though, and an extremely important one, is that if you do not have public pressure, or public interest in terms of retaining those very key habitats, the biologist in government isn't going to be all that successful. There was reference made

also to the need for better environmental controls. Our habitat protection biologists are out there doing the best they can to put conditions on development permits that are issued under the authority of the public lands act or other acts, and quite often the basis by which we put those conditions on, in relation to our basic knowledge, is very poor.

Bill Hall:

I am going to try and relate my comments to those made by the panel members. Firstly, there is no experienced wildlife manager who doesn't realize that the first thing he has to have if he is going to have management of any kind, is land, and he must respect the ownership of the land, whether it be crown or private. So, that is the basis from where we begin most of our management programs. A second point is that people seem not to understand that we are not wildlife managers in total, because a great percentage of our time and effort is spent on managing people and not wildlife. I say that from the standpoint that our seasons and zoning are based on the availability of land and the use of wildlife by people. The species used and the activities taking place on that land all involve people. These concepts have to be addressed in wildlife management and I would state the biggest percentage of our time is spent on trying to manage people so that the people going out there will be welcomed by those who own the land.

To comment on the remarks of Vivian Pharis on zoning changes, the ecological zoning zones that we had 3 years ago is no longer in existence because we took a serious look at what was taking place out there, and we structured our zoning to meet the activities and available species, as well as the requirements of landowners. There are a number of techniques available to us, to increase harvest, but again, especially in the privately owned land areas, there are a number of land owners who don't want large numbers of people on their land. Therefore, we try to adjust the

numbers going out that will satisfy landowners, and again this reflects in our inability to always be able to harvest that segment of the population we would like to. We try to keep the numbers of people down so that the landowner isn't swamped. I hope I have pointed out some of the complexities of wildlife management in response to some of the concerns expressed by the panel.

Dr. Birdsall:

Thank you very much. We now have completed all the speakers. I believe that a brief comment might be useful concerning some characteristics of commercial fisheries management in the Pacific region of Canada, which I believe may signal things to come in fish and wildlife management everywhere.

The first comment is with respect to communication. The emphasis now is on marketing, and marketing fish management to the people has simply exploded in the Pacific region. The new Minister of Fisheries, John Fraser, has introduced the process of co-management. The users of the fisheries resource in the Pacific region now have a full role in management decisions. Co-management means that with respect to ocean sport fishing, the sport fishermen representatives meet the fisheries managers and the regulatory package that is put out comes from them. So, the new sport fishing regulations that will hit salt water fishermen when they get announced in the next few weeks, will be regulations that came directly from the users, not from the managers. Several of the fisheries managers came close to being unemployed because they suggested that they had a package of regulations already. The communications aspect of fish and wildlife management can't be underestimated. Secondly, no longer will biologists in the public sector be allowed to do research without public communication, and thirdly, they won't be allowed to do enforcement without public communication.

My prediction is that you will see major parts of fish and wildlife departments within the next ten years, devoted exclusively to marketing what they do for the people. I have the report on Chinook salmon here which is the first public communication by the Canada Department of Fisheries with respect to a species that was in great danger. There still is not available in the Province of B.C. any public information, with the exception of this report, on the crisis in Chinook salmon. The new minister is saying, we'll change all that. From now on we are going to go to the people all the time. The public is going to get informed.

The other thing I wanted to mention goes along with something Tom Mill said. I think it can be demonstrated that habitat loss is a misconception with respect to the Pacific salmon. The problem with Pacific salmon is that they are over utilized by the consumptive users. There is not a fish habitat problem that can be demonstrated throughout most of B.C. The problem with salmon is harvesting. I say that again as a generalization. I think there are a few problems with cohoe salmon in a few areas, but by and large the habitat issue is over-emphasized. I don't mean to suggest that it is over-emphasized in Alberta, but I bring that up as a comment that might deserve some comparisons later in the discussion.

DISCUSSION

Ron Gladish:

Sam, in regards to Metis or Indian self-government especially, you made reference to the fish and wildlife resource. What type of an area are you talking about in the province of Alberta?

Sam Sinclair:

Where our people are, and by the way you mentioned that your Association, the Alberta Fish and Game Association, has 24,000

members. We have over 100,000 members. When we are talking about self-government, the Treaty Indian are governed in a different way in which they come under the Federal jurisdiction. By the time this is sorted out, no doubt we will come under Provincial jurisdiction, with some laws that we need to be changed that directly affect our people. So, that means all of Alberta for the Metis, but seeing our population is probably 80 percent north of highway 16, it'll probably be north of Edmonton mainly.

Lorraine Allison:

I'd like to ask Mr. Sinclair if under a co-management model, which is essentially I think what you were proposing, would there be any objection that you can see to developing good harvest statistics for the animals that you and the Treaty Indians are using

Sam Sinclair:

Well, in the short terms, our Metis people get 200 special permits every winter and about 60 percent of those are harvested. It wouldn't be hard to get the count of different species of animals that are taken by reserve people. What is hard to get is the total cooperation of treaty people that live in urban areas, where there really is no control. Again, I can't speak on behalf of Treaty Indians. This is why we want to be part of the action. We want to control how many animals are removed. We also are very concerned about American hunting, which does harm our harvest in Alberta, especially for the use we want for our people. Rather than having game exported to other countries, we'd like that resource to stay here. So, these are the kinds of things we'd want to be sharing with the government in managing the wildlife resource.

Vivian Pharis:

Mr. Sinclair, do you see game ranching as a feasible alternative or something the Metis people would like to get involved with?

Sam Sinclair:

Certainly. I'm glad you brought that subject up because that was one of the topics which interests us. We already have some people with a game farm in the eastern part of Alberta, who are raising buffalo and are looking at the prospects of raising elk. It is definitely an industry we are looking at seriously and when we are negotiating with the government, we will probably be asking for specific lands for that particular resource and to be encouraged to get something started. As an example, we know that places like Grande Cache have large areas that contain good habitat for elk and other species. We might want to look at those kinds of things. But again, we want to do it jointly with the present government and hopefully we can come up with some kind of agreement. Hopefully, this can be done in a proper manner, reasonably, so that it makes people comfortable on both sides - the Aboriginal people and yourselves.

Harry Stelfox:

One question, Mr. Sinclair. What initiatives are the Metis people or the Indian people taking to train young people in the wildlife management area, so that you can position yourself to perhaps become more actively involed at a future date?

Sam Sinclair:

We've looked at all aspects of training programs that could be made available. We've had a number of meetings with Mr. Surrendi and some of his staff. It is a very small, isolated position right now, because it's something we have to do slowly. We don't want to start promising our people something that isn't probably practical at this point, but we have quite a number of Metis people now at the grade 12 level. Unfortunately, when they look for a job in wildlife management, they are told there is no opening for that kind of a position. But we are fortunate in having organizations like NOVA, which hire people on the basis of training and the right attitude.

We have very few people that have a University Degree, but we have quite a number of them with CS as a degree; and that's Common Sense. We hope to see Metis fish and game officers trained under the same method you people use for training your people on enforcement and other areas of conservation. Where we would probably have to work jointly with you people in areas where there is a heavy native population, we would want our people to police that particular area. Hopefully, they also will learn how you preserve game, along with management. If we get our people qualified we want them hired in wildlife management positions.

Unidentified speaker:

One comment on what was just said with respect to co-management. The co-management process on the pacific coast now involves all the users, I believe, except native people, and the reason it doesn't involve native people is because the co-management issues and the aboriginal rights issues that are being dealt with, with the Provincial and Federal governments, are one and the same thing. When the aboriginal rights situation is settled, when the guidelines are settled, they will automatically mean co-management, I'm sure. I think that what the minister has done in that case in B.C. is to steer away from the co-management issue concerning native people right now because it would get tangled amidst all the other issues.

Unidentified speaker:

I would like Lorraine Allison to comment on the public hunting on private lands.

Lorraine Allison:

On our home section, where we live, there are very few angles at which your rifle is not pointed at someone's house. There are a number of homes along the creek, and we have simply found that it's too dangerous. If we have let people on to hunt, either they

are shooting at the neighbors, or they are shooting at us, and I'm not exaggerating. So, despite the fact that we would like to allow people to hunt on that section, we do not. We would like to be asked and the straight fact is that we are not asked. Only one neighbor has ever asked for permission to hunt on our land and we commonly have cattle in the areas where people are hunting and we commonly have the gates broken. We commonly have had the cattle mixed or moved as a result of the activities of trespassers. As far as dealing with hunting, we almost feel as if we have to police it, and that's unfortunate. I suppose one of the ways of dealing with it might be stiffer trespass regulations, although I wouldn't necessarily like to see that. Another way might be to look at ways of prosecuting people for careless hunting, but again, sometimes it is even hard to catch up with trespassers. There was an instance in which we were working cattle in a set of corrals right near a house and somebody stopped on the highway and shot up a road allowance. Our men heard the bullet as the bullet hit the ground. The hunter had missed the deer and hit the ground, so they went out after him to try to get his license number, but he disappeared. So, the solutions are not easy ones and we recognize that. Some of the things that have been tried with larger landholders up around the Nanton area may work. The pilot project that was attempted up there seems to have been successful and we would also like to see responsible hunters taking some responsibility for dealing with irresponsible hunters when they see them.

Ken Crutchfield:

A question I would like to see the panel address is: How can we educate the user who doesn't see himself as a user right now, but who can in the foreseeable future very quickly become mobilized as a user, such as with the seal hunt, but maybe along a different line, here in Alberta?

Neil Jennings:

One thing that Lorraine Allison and I were discussing earlier was the unfortunate use of the words consumptive and non-consumptive. It seems to me that anyone who is a user, be it a birdwatcher, a fishermen who releases what he catches, or a birdhunter, all those people are users of the resources. I have a great deal of difficulty believing a person watching peregrin falcons is not a consumptive user. He is not, hopefully, going to take falcons home and attempt to dine on them, but nevertheless he is a consumptive user. With respect to how you defend yourself against the animal liberationists, I think it really is a question of public education. The fringe groups are always going to get the press.

Don Young:

I have a question concerning a recurrent topic. It pertains to the public communication aspect that we talked about today, as well as the luncheon topic, and it pertains to professional biologists in general. The position we are often in, in terms of responding to the laymen in general, occurs during debate on potentially controversial topics. Perhaps I should address this to the representatives from the Fish and Wildlife Division, but it might be answered by any of the panel members. The topic is obviously one of considerable controversy, given its international implications right now and it pertains to Lubicon Lake. As the public in general, including ourselves, we are currently being inundated with information, through the media, that the wildlife resource and the livelihood of the natives in the area are being compromised by industrial development. The lack of a position statement by professional biologists able to respond to the current media statements, I believe to be a problem because I'm sure other people are being asked as professional biologists if what is being stated in the media is in fact a real problem. It is the mandate of the Fish and Wildlife Division to respond in order to

counterbalance some hysterical topics that are being raised in the media. I'm not certain of that, but my question is: How do you resolve the issue of informing the public concerning professional opinions on wildlife management to counterbalance some of the statements in the media, while operating with the constraints of a government structure which includes other topics, such as energy development in the province?

Ken Ambrock:

You raise a number of points in your statements, and I think you could just as well ask that question of the biological profession at large. You have to appreciate that in the context of the Lubicon land claim, it involves a situation that was before the courts. I don't think that our biologists were in a position that they could freely offer information to the public at that time. There was some work done by our biologists reviewing information, specifically in the Lubicon area to see if in fact moose and furbearer populations were down as a result of oil and gas activity. The analyses from our biologists stated that they could not correlate the fluctuation in wildlife populations with anything other than what was normally occurring throughout the northern part of the province. Secondly, it was suggested that productivity of the area for moose was down because we have an over-mature forest in that specific area. The information could not be correlated with oil and gas activity, as some of the concerns the Lubicon people had expressed.

Lorraine Allison:

I'd like to simply expand a little bit on what the questioner said. To remark that despite what we heard about public involvement and public participation, it is a continuing problem for various groups to get Fish and Wildlife Division representatives who know the situation well to speak in public forums. In Alberta, it seems to be a particular problem, which is greater than in other

jurisdictions in which I've worked, and I would really like to see some improvement in that. For instance, at public hearings I think that professional biologists should not only present background material, but should be there to be questioned on matters of fact, by the public and that just simply doesn't normally occur.

Harry Stelfox:

Maybe I could follow up on the last couple of questions and try to get some clarification. My perception is that we frequently do a biological analysis of issues that come up in order to brief senior management and the minister. I'm wondering if biological analyses are getting past the minister and out to the public and if not, why not?

Unidentified speaker:

When an issue is politically sensitive, whether it's a land claim issue, or whether it's a controversy on an interpretation of statute, a regulation, or the lack thereof, relating to public access, or whether it is information relating to the construction of developments or the expansion of industry and its potential effect on wildlife, or fish, and our client is the government, that client sometimes requires that we give our judgement in confidence.

Where the decisions are likely not to please all of the interested parties, the government may well exercise their client right privilege. Similarly, as a client to a biological consulting firm doing a contract for me, I may well want to exercise my right of privilege to maintain confidentiality with that information. That is the case with things like the Lubicon Indian Band situation, or the Three Rivers Dam or what a public servant can say at a public hearing with the ranching community. Each of us as a professional has to exercise some judgment to carefully say what we think we can say, or what we think we ought to say, or if necessary, to look for another line of work.

Neil Jennings:

I harken back this morning to something Dennis Surrendi said in terms of the users being clients, rather than the elk being clients. Lorraine Allison and I do have a divergence of view in respect to what rights a leaseholder has in a grazing lease situation. Lorraine and I may be able to solve that if we sat down, but if we reached a resolution that was acceptable to the two of us, we do not have the power to enforce our view of that. I think my point is that the divergence of our views is the best evidence that you need have, and that there needs to be a resolution of the question at issue. In order to serve the clients, the government has to reach that resolution to avoid any adversarial position between various interests.

SESSION III

MANAGEMENT TECHNIQUES WORKSHOP

1. FISHERIES MANAGEMENT TECHNIQUES
   CHAIRMAN: Mr. C.E. Stenton

2. WILDLIFE MANAGEMENT TECHNIQUES
   CHAIRMAN: Mr. S.E. Stephansson

INSTREAM FLOW NEEDS ASSESSMENT METHODS

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In recent years, water resource managers are being asked with increasing frequency to prescribe stream flows designed to protect aquatic organisms from the effects of stream regulation. These flows are commonly described as the "instream flow needs (IFN)" of fishes and benthic invertebrates. The need for a predictive tool to assist in setting instream flows has led to the development of IFN assessment methods. These methods are essentially techniques used to examine the relationships among stream hydrology, stream hydraulics and the physical habitat requirements of fish. The methods use models of varying complexity to correlate a range of flow rates with aquatic habitat quality or availability. The objective of this paper is to briefly outline what is meant by the term IFN and IFN methodologies, and then describe, in general terms, the basis for the three major groups of instream flow assessment methods that have been developed over the last two decades.

Perhaps the first question which springs to the mind when a biologist first encounters the term "instream flow needs" is what is an outstream flow need? A number of water users, however, are offstream and it is clear that a large portion of our river systems are not dedicated only to uses between their two banks. Municipal and industrial demands both draw water out of rivers and steams and either do not return the water, or return it in a form quite altered from its natural state. In southern Alberta, an even more significant water user is agricultuire. Irrigation draws huge amounts of water, and returns little or none of it back to the river. For example, during the 1984 drought, roughly 50% of the Highwood flow was diverted into the Little Bow River, primarily for

irrigation purposes, and over 90% of the flow in the Oldman River was diverted directly into the LNID irrigation system. Therefore it is clear that offstream use of water, whether for irrigation, industry or any other requirement can be significant.

It should also be emphasized at the risk of belabouring the obvious that fish are also not the only instream users of water. Albertan streams are used for sewage dilution, for hydropower production, for boating and for a myriad other uses. However, in Alberta, I believe that the general public still perceives the protection of fisheries resources as a major environmental requirement and it is our mandate, as professional biologists, to help protect that resource.

Just how do IFN assessment methods assist biologists in fulfilling this mandate? Put in the most simple terms, IFN assessment methodologies allow biologists to express the needs of fish in the common units of hydrologists and engineers, in m^3 of water per second. Most aquatic biologists have at one time or another been faced with the question "So how much water do your fish want?" This question takes on particular urgency when it is being asked around a table where everyone else has an answer for his particular interest group, where the hydroelectric engineer can describe in great detail the peak and base loads he requires, where the civil engineer can indicate to the nearest cubic foot per second the diversion capacity and requirements of his irrigation system, where the waste treatment engineer knows precisely how much dilution capacity he needs to ensure that his effluent meets the government water license. And it is a legitimate question: If biologists wish to have any credibility with the other technical specialists responsible for managing water in this province, we have to be able to set reasonable, defensible flows for the protection of aquatic ecosystems.

In order to set defensible stream flows, however, biologists require the appropriate tools. This is the primary function of the 20 or more IFN methods that have been developed.

Their common premise is that, provided the stream meets the other habitat criteria of the local fish species, such as adequate oxygen levels and a reasonable temperature range, then the method can be used to predict a stream flow adequate to maintain physical aquatic habitat at an acceptable level.

The aquatic habitat characteristics modelled are those termed by Bovee as microhabitat, that is channel structure features such as channel dimension, slope and substrate, and hydraulic chracteristics such as wetted width, wetted perimeter, water surface elevations and velocities. Macrohabitat characteritics, such as water quality and temperature, while they may be critical to the IFN assessment are not generally addressed directly by the IFN methods, and are usually assessed using other modelling systems. Depending on the model selected, these techniques can be used to predict minimum annual flows, minimum seasonal flows, or even to document gains and/or losses in habitat over a range of flows.

The available IFN methods can be generally broken into three distinct groups with common approaches and objectives. The first group are generally termed discharge or office methods, the latter name originating from the fact that the methods depend on real or simulated stream flow records rather than site-specific field data. All the discharge methods are based on the assumption that aquatic habitat is a function of recurring discharge patterns in that system, and that one or more flow statistics can be used to determine the minimum flow required to protect and maintain that habitat. These flow statistics include drainage basin area, flow duration, and percentages of mean and median annual and monthly flows. The most widely known of these techniques is the method developed by Donald Tennant and is often called the Tennant or the Montana method. Tennant looked at a number of streams and rivers under a range of flow conditions. Based on this empirical data base, he established a series of flow conditions, based on percent of mean annual flows, which appeared to provide similar levels of aquatic habitat protection regardless the size of the system.

Interestingly, the Tennant method, probably because it is so simple, has been severely criticized by a number of water and fisheries managers. However, in study after study, it has also been shown that, in fact, most of the water requirement predictions of the Tennant method are quite comparable to those generated using much more complex methods, particularly if the model is modified using a little common sense to meet any unique hydrological or biological conditions in the system being studied. This is likely due to the fact that the Tennant method, although simple, is based on a very reasonable assumption. Both stream systems and aquatic habitat quality are a function of discharge, and fish populations are likely to be adapted to some commonly recurring flow regime. A fixed percentage of the flow regime should provide good stream habitat conditions, provided the other, perhaps unique features of the stream are considered. There is a strong logical and intuitive attractiveness to the concept that aquatic habitat, and aquatic populations are, over the long run, a product of recurring hydraulic events. What is needed is much more long term research into the effects of these recurring stream flow patterns. I believe establishing these relationships would be invaluable in providing relatively simple, objective and defensible techniques for establishing required flows needed to protect Alberta fisheries resources.

The second group of methods are commonly called hydraulic rating methods. These methods use field measurements of depths, velocities and channel configuration at a single transect to calculate or simulate a range of hydraulic conditions under different flows. These single transects are generally located in stream habitat defined by the researcher as being critical to local populations. The hydraulic variables calculated include mean depth, mean velocity, percent retention of wetted perimeter, and weighted useable width. These hydraulic parameters are then used to rate the quality of habitat (and hence the name, hydraulic rating methods) under various, often simulated, flows. A variation of this method

was used to generate acceptable stream flows for fish in the recent South Saskatchewan River basin planning process.

If the discharge methods have been undervalued in the planning process, then the hydraulic rating methods, I believe, have been considerably overvalued. I have reviewed these methods extensively, and generally have found them to be of questionable value in instream flow assessment, particularly when applied to a stream environment where they were not developed for site specific purposes. The methods are unacceptable for a number of reasons, both biological and hydrological.

First, many of the statistics calculated appear to have little value in describing the quality of aquatic habitat. For example, it is difficult to understand how mean depth or mean velocity across a transect actually correspond to the needs of a fish which is undoubtedly only using one small portion of that available habitat. Wetted perimeter inflection points seem to have a certain intuitive appeal, but on closer examination, appear to be so site and stream specific that they have little general value. Percent retention of wetted perimeter is likely of even less value; I have certainly never seen any data which supports its use as an index of habitat quality.

A second weakness in hydraulic rating methods occurs when the basic assumption of the methods is violated, that is when the data are not collected from habitat judged to be critical to local fish populations. This occurs primarily when existing gauging data, collected by Water Survey of Canada or other hydraulic agencies are used rather than field data collected specifically for the study. The point is that these data are inevitably <u>not</u> from critical areas. At best the habitat modelled is judged representative, but usually cannot even be considered that. This use of non-critical habitat data is a major violation of the hydraulic rating method assumptions.

Another weakness of the hydraulic rating methods is that many of the hydraulic models used to calculate the hydraulic data

are inappropriate. Biologists must understand that the first hydraulic models were generated to predict depth, flow and velocity in open concrete channels. Even when these models were applied by engineers to rivers, they were used to predict phenomena such as flood stage and discharge. The engineers using them certainly had no interest in modelling specific points across winding braided channels at the low flows which are precisely those points in the river of biological interest. What has happened is that biologists have attempted to modify hydraulic models to fit into their needs to describe aquatic habitat. The problem is that some of those models, particularly the simpler, and therefore often more attractive models, are simply not appropriate for even slightly complex hydraulic conditions.

The third group of IFN assessment methods are generally labelled the preferred area methods. Of these, the Instream Flow Incremental Methodology (or IFIM) is by far the best known, and in many ways, represents very major advances over the methods described earlier. Developed by the Cooperative Instream Flow Service Group in Colorado, IFIM generates areal estimates of fish habitat by overlaying indices of preferred depths, velocities and substrate conditions with measured and simulated estimates of the availability of these conditions in an entire stream reach. The method relies on multiple transects, on a broad base of hydraulic and biological data, and on computer simulation, and therefore is very expensive and labour intensive. However, it is widely accepted and clearly represents the state of the art in instream flow assessment methods. Perhaps the major advantage of the method is that it permits incremental changes in habitat availability to be modelled under a wide range of flow conditions. Therefore the fisheries manager can use the technique to assess the effects of an entire range of flow options and when used in this manner, IFIM becomes a particularly valuable planning tool.

Like any model, IFIM is based on a number of simplifying assumptions. The model is not a panacea; major violations of these

assumptions invalidates it use just like any other model. However, the model is also continuing to evolve, and I would like to briefly discuss a point that is critical to the application of IFIM, but often overlooked, particularly by biologists since it deals with the hydraulic components of the model.

Ironically, what we are finding is that for many new IFIM applications, it is the hydraulic modelling capabilities and not the biological data base which is limiting the model's use. The hydraulic models adapted by Colorado are relatively vigorous by hydraulic modelling standards, but still seem to fall apart much too often in exactly those hydraulic conditions of biological interest.

If any research were to be initiated in this province into IFIM, I would strongly suggest it be directed at developing hydraulic models specific to the needs of biologists. I truly believe that without some advances in this area, further refining of our biological data base will not improve our overall predictive capabilities.

Perhaps the major advantage of IFIM to fisheries management will occur when the techniques are sufficiently refined that they are able to tie stream habitat quality and stream habitat productivity together. A very recent piece of research suggests that we are approaching that capability; however it also clearly underlines the pitfalls that we still face.

The research was carried out by Mike Sale of Oak Ridge National Laboratories in trout streams in the Applachian Mountains. What Mike was trying to do, among other things, was to determine whether predictions of <u>habitat quality</u> for rainbow and brown trout made using IFIM could be used to predict <u>productivity</u> of the stream systems. Mike's findings were very interesting. He found that in streams containing only rainbow trout or only brown trout, habitat and productivity were closely correlated. However, in steams where both species occurred, brown trout populations continued to be predicted by habitat, but rainbow trout populations did not. It would appear that interspecific competition and not habitat quality

was controlling rainbow trout productivity.

This latter finding was not particularly surprising. Existing standing crop is clearly a function of a wide range of earlier historic pressures including emigration, migration, fishing pressure, stocking rates, cohort spawning success, and interspecific competition. As well, all fish species have sufficient behavioral plasticity to temporarily move under adverse conditions into much less favorable habitat or to withstand a certain amount of overcrowding for some period of time without demonstrable adverse effect. Therefore, to use IFIM to say that habitat availablity at one point in time was X and therefore standing crop at that some point in time should be Y is almost guaranteed to fail to produce adequate correlations. However, I do believe that longer term relationships between average habitat quality/habitat productivity can be established using IFIM. I also believe that if an accurate measure is available of average standing crop pre-and post project, and if IFIM predicts a significant change in available habitat, then a similar change will be demonstrable in <u>average</u> post project populations.

In conclusion, it apears that two IFN methods, the Tennant Method and the Instream Flow Incremental Methodology appear to be the most applicable to the needs of Provincial biologists. It is recommended that once the most approprate methods for assessing instream flow needs in Alberta have been confirmed by Alberta Fish and Wildlife that a long term research program be initiated to gather better empirical data on the relationship between streamflow and aquatic habitat, to increase the IFIM habitat utilization base for both cool and warmwater species, and to develop more refined hydraulic models for use in future IFIM assessments.

RECLAMATION OF STREAMS IN ALBERTA

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INTRODUCTION

The reclamation of aquatic environments in Alberta is a relatively new fisheries resource management option. While reclamation activity has increased significantly in the last decade, fewer than 100 sites on water bodies can be described as having been effectively reclaimed.

The reclamation of aquatic environments in Alberta has been concentrated on the province's east slope streams, largely because the impetus for reclamation comes from the important aesthetic, recreational and watershed qualities characteristic of coldwater salmonid streams located in western Alberta. Northern brown water streams and standing waters have had a lower priority for reclamation for fisheries purposes.

The objective of reclaiming streams is to improve degraded fisheries habitat to a higher level of quality, thereby mitigating losses of fish production due to cultural or natural disturbances. Reclamation can be described as restoration or rehabilitation, which both imply reclamation to former conditions and also may be termed enhancement, implying improvement over existing conditions.

Reclamation of disturbed sites on streams should include rehabilitation of in-stream habitat components. Substrate reclamation may be necessary, either by replacing suitable material or by removing deleterious material such as sediment deposits. Instream cover provided by debris such as logs and stumps or by aquatic vegetation should be re-created. Suitable hydraulic characteristics should be restored by creating appropriate pool/riffle ratios and allowing for or creating thalweg deflections. Such measures normally require structures within the channel such as ledges to create scour pools, current deflectors or addition of materials to reduce depth

and increase velocity to create riffles. Many of the materials mentioned for bank stabilization can be utilized to create these structures and have been successfully employed at a few sites in Alberta.

Both the methodology for stream reclamation and the expertise to carry it out are available in Alberta. However, at present few disturbed sites that degrade habitat and fish production potential are being reclaimed. Given the probable cumulative historical losses of quality stream habitat and the potential for continued degradation, perhaps it is time to assure Alberta's trout streams the protection needed to reduce further losses and reclaim some of the losses incurred in the past.

THE NECESSITY FOR STREAM RECLAMATION

Examples of stream reclamation for fisheries in Alberta prior to 1970 are rare. Greater environmental awareness in the last decade and significant increases in industrial activity in Alberta's east slopes led to the initiation of reclamation of streams at a small number of sites in the early 1970's. Despite the increase in stream reclamation activity in the last decade, the total number of reclaimed sites remains relatively small compared to the number of disturbed sites. One small but popular and productive 18 km trout stream near Rocky Mountain House has been impacted to varying degrees by 6 pipeline rights-of-way, 19 seismic lines, 4 road crossings and 5 power transmission line rights-of-way, however only 2 sites have been effectively reclaimed. Most streams in the east slopes suffer similarly from numerous disturbances which, while perhaps small in area, can amount to significant proportions of total available fisheries habitat when considered cumulatively. Legislation and regulations regarding reclamation do not specifically address aquatic environments and are apparently difficult to apply, as stream reclamation has been undertaken on an irregular and apparently haphazard basis. Losses of stream habitat due to large surficial disturbances such as surface mining operations occur less frequently and perhaps because they are more obvious and fall under different regulations, tend to be reclaimed more expeditiously.

Agricultural activities, certain aspects of timber harvesting operations and some linear developments such as power transmission lines have somewhat insidious effects on stream habitat. Generally these activities alter the riparian vegetation community that provides natural, long term bank stability, leading to increased slumping and erosion which results in low level, long term siltation; increased exposure; a wider, shallower channel and increases in water temperature, all of which degrade habitat quality.

Construction of permanent cultural features such as roads, railways and pipelines and the channelization and diversion of streams tend to directly disrupt channel and bank integrity. Riparian vegetation is frequently completely removed, the stream bank soil and subsoil structure altered and the channel substrate and in-stream refugia removed or tampered with during these activities.

Natural disasters such as landslides and floods may occasionally require the use of reclamation to mitigate their effects.

STREAM RECLAMATION METHODS

Most of the reclamation techniques currently in use on streams have been adapted from systems developed in Europe over the last several centuries or from habitat enhancement techniques devised in the eastern United States. New and innovative uses of synthetic materials and modern construction techniques are being successfully applied and stream reclamation can now be generally described as a bio-engineering discipline.

Because of the specialized nature of the reclamation of aquatic environments, an in-depth understanding of the inter-relationships of stream habitat components and their role in fish life cycles is necessary to design and implement successful reclamation. Knowledge of hydrology, engineering and construction methods and riparian ecosystems is also required. As usual when dealing with natural systems, any design must be flexible enough to meet unexpected circumstances that are sure to arise.

The riparian vegetation community on stream banks provides natural long term stability as well as cover and shade, therefore re-vegetation is an important component of stream reclamation and the sooner vegetation can be re-established, the less the impact on the fisheries resources of the stream.

Fencing of stream banks to exclude livestock grazing is both a protective and rehabilitative measure. The objective is to allow the re-establishment of a stable, natural riparian plant community. The Fish and Wildlife Division of Alberta Energy and Natural Resources has had some notable successes with this method, however recovery can take long periods, particularly if bank slumping and erosion has been extensive.

Occasionally, where the threat of erosion is non-existent, revegetation is all that is necessary to reclaim stream banks, however the practice of seeding a mix of grasses and legumes designed for upland areas is inadequate. The root systems of shrubs and trees provide niches for fish. In order to quickly establish this type of plant cover with extensive root systems, transplants of mature individual plants or clumps of appropriate local species such as willows, alder, spruce and poplars should be utilized. Seeding or placement of cuttings of shrub species is not normally successful as they usually wash out before establishing an extensive root system. Some more hydrophytic or aquatic species such as sedges, cattails and bull rushes can be transplanted as clumps of sod, however some form of physical anchoring system is usually required until root systems become established.

Where the stream banks and channel have been extensively disturbed and their integrity disrupted, some form of hard structure is usually necessary to resist erosion and provide a stable base for vegetation to re-establish. A variety of materials can be employed in hard structures and they can be designed to create bank cover for fish. As logs are usually locally available in the foothills, the banks of foothills streams can be effectively stabilized using a variety of log structures. These techniques have been used successfully at a number of stream reclamation sites in Alberta. The banks

of streams with widely fluctuating flow regimes and/or high gradients are best stabilized using rock placements, live rock systems or gabions. The former two methods are usually more aesthetically appropriate. All three techniques have been utilized successfully at a few sites in Alberta. Metal sheet piling can be used to stabilize disturbed stream banks, but has some aesthetic drawbacks and is relatively expensive. Precast concrete devices have limited potential by themselves, but can be effectively incorporated with other materials. Synthetic materials, particularly new designs in erosion control matting, are being utilized with success at some sites, especially where floating hydrophytic plant communities require anchoring to allow root establishment. In all cases where hard structures are utilized, extensive revegetation must be undertaken to mitigate the aesthetic impact of the structures.

PHYSICAL STREAM IMPROVEMENT

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INTRODUCTION

Fishermen familiar with stream environments know where fish can be caught; these places of catch are generally located near objects of cover such as a boulder, an overhanging bank, a floating log or an area of turbulence. Any fisherman who observes closely while he walks a stream will also notice that fish are rarely found in other stretches. The simple explanation for this phenomena is that under natural conditions, favourable environments for fish rarely exist uniformly throughout the length of the stream. Fishery biologists recognize cover as one of many environmental factors, in addition to temperature, food, water velocity and flow which limit the number and biomass of fish in streams. In Alberta, where current demand for stream trout fishing may soon outstrip supply, physical habitat improvements offer the potential to increase carrying capacity for fish populations and concomitantly, for better recreational angling opportunity. As part of an overall management program, much can be done to improve fishing by making streams more suitable places for fish to live.

Stream habitat improvement is a broad term encompassing many aspects of an overall habitat protection and management program. For this paper, improvements will be discussed in terms of structures and devices to physically improve fish habitat in streams.

Like most of our methods of fishing, stream improvement was imported from England where trout waters have been actively managed for generations. The first impetus for habitat improvement in North America came during the 1930's in the United States, where large amounts of relief funds made available to government and state agencies made it possible to carry on experiments in a large way with

various types of installations designed to improve conditions for trout (Needham 1938). Early efforts at improving the lot for fish were aimed in the right direction but often met with failure, as in early attempts in any new science. One of the fundamental problems, as evidenced in early "cook books" of habitat improvement (Silox 1936), was the application of an engineering solution to a biological problem; often elaborate structures were designed and constructed without an understanding of the habitat requirements of the fish present in the stream. It was a case of fitting the stream to the structure rather than vice versa. However, some of these early attempts produced positive responses in fish populations and in concert with a better understanding of the requirements for fish life that occurred later, the principles of habitat improvement became more obvious.

In Wisconsin, trout habitat studies during the 1950's and 1960's led White and Brynildson (1967) to their milestone publication, "Guidelines for management of trout stream habitat in Wisconsin". The principles of habitat improvement, summarized by White and Brynildson in that publication, are worth repeating:

"Follow Nature's Lead

Do not construct devices just because they are "in the book". Let nature call the shots. For the observant habitat manager, the needs of the trout and the characteristics of the stream itself will be the truest guides to good management. The lay of the stream will suggest the best locations for structures. Expend only enough effort to achieve the reasonable potential of the stream. Habitat management is fundamentally a problem of biology, not engineering. Rather than trying to improve on nature, we will do well to open the way for nature to improve the stream herself - an efficient and aesthetic practice.

Treat Each Stream Individually

No streams are alike. Each has its own distinct character and its own special problems. Although some basic similarities among streams exist, one must temper general recommendations with

individual judgements. Each stream should have its own tailored management plan.

Keep the Whole Stream in Mind

Manage habitat with regard for the way the whole stream functions as trout habitat. To develop short, miscellaneous sections without knowing their role in the stream's ecology can be wasteful. For instance, to alter riffles in a section comprising the only spawning habitat might injure the whole stream's population. On the other hand, it would be futile to make special efforts to preserve as spawning grounds some riffles such as we have seen, where few trout spawn and where eggs develop slowly and survive poorly owing to severe and prolonged cold each winter. Make a thorough examination to identify ecological zones: steep, riffled sections or slow marshy sections or cascades, etc. Then decide how each might be altered to function better within the entire habitat.

Preserve Natural Character

To enhance the quality of fishing opportunity, maintain the natural character of streams. We repeat the warning against overmanagement and artificiality expressed in the introduction, and point out again that it will often be difficult to reconcile the need for preserving "stream personality" with the urge to raise its trout productivity by radical alterations. Be prepared to tone down intensity of management for the sake of the natural aspect. The instream structures recommended in this booklet can be built inconspicuously."

The literature on stream habitat improvement is plentiful, but is scattered in fisheries journals, state and provincial publications, completion reports for federal aid projects, state conservation magazines and often in journals outside the field of fisheries. Interested readers are directed to a publication co-authored by Wydoski and Duff (1978). A substantial amount of information on hundreds of stream habitat improvement projects from 14 states is found in the Proceedings of the Rocky Mountain Stream Habitat Management Workshop (1982). Unfortunately, the publication is out of print.

PHYSICAL STREAM IMPROVEMENT DEVICES

Structural improvements available to physically improve habitat in streams fall into four general, but not mutually exclusive categories. The following is a summary of these structures with their purpose and their functions:

1. Flow Deflectors

   Purpose - to encourage the meandering nature of streams which creates deeper channels.

   Structures available - wing deflectors (log or gabion construction - rock filled), deflector logs, rock jetties, log cribs (rock filled).

   Functions expected -

   a) reduce bank erosion
   b) create pool habitat on meander bends
   c) collect sediments (on point bars)
   d) provide growing sites for riparian vegetation
   e) create deeper, narrower channel through scouring
   f) enhance fish cover through pool development and deeper channel

   Construction considerations-

   a) triangular shaped structures, solidly anchored with pins, rocks and soil produce best results
   b) locations for placement critical
   c) structures should guide current rather than dam it
   d) structures should be built low to discourage debris collection

2. Bank Covers

   Purpose - to enhance fish cover adjacent to the stream bank and to prevent bank erosion

Structures available - bank overhangs (artificial undercut banks), gabions, rock rip-rap, tree/bush revetments, stream bank fencing, boulder retards, revegetation.

Functions expected -

a) create overhead cover
b) prevent bank erosion and flood damage
c) collect and stabilize sediment
d) provide stable growing sites for riparian vegetation
e) reduce current velocities in bank area
f) narrow and deeper stream channel
g) restrict livestock damage
h) restore riparian vegetation root structure (stabilize stream bank)
i) enhance aesthetics

Construction considerations -

a) undercut banks should be combined with deflector structures
b) rock rip-rap to be sufficiently large to resist movement and provide cover
c) toe of rip-rap slope to extend below water line to provide habitat
d) access for heavy equipment often necessary
e) tree/brush revetments inexpensive to construct
f) boulder retards (cabled boulders) useful in flood prone streams
g) restoration of riparian vegetation may be most cost effective measure
h) flow conditions critical in assessing devices to be used.

3. Low Dams and Weirs

Purpose - to provide or deepen pools in high gradient areas and enhance cover through turbulence, increased water depth and reduced current velocities.

Structures available - log, rock or gabion dams, "K" dams, wedge dams, Hewitt ramps, rock plunges, upstream "V" dams, log, rock, tie or gabion weirs (overpours), notched weirs, step dams

Functions expected -

a) deepen existing pools through scouring
b) create new pools in long reaches of high velocity water
c) enhance overwinter habitat (deep pools)
d) create low velocity resting, rearing cover
e) provide overhead cover
f) enhance fish movement over barriers

Construction considerations -

a) flow conditions critical in assessing devices to be used
b) site selection critical
c) assess for heavy equipment often necessary
d) wings of dams must be securely keyed into stream banks
e) stable banks required below structures
f) periodic maintenance required
g) proper seals required to prevent undercutting
h) structure should blend with steam and remain inconspicuous

4. Instream Cover

Purpose - to provide overhead cover and reduce velocity in mid-channel locations

Structures available - boulders, trash catchers, cover logs

Functions expected -

a) create overhead cover in exposed mid-channel locations
b) reduce current velocity in high gradient sections
c) provide resting, rearing cover
d) increase current velocity in low gradient sections to scour pools
e) deflect stream flow in smaller streams from unstable banks
f) in concert with other structures, restore meander patterns

Construction considerations -

a) boulders should be sized to the stream to resist bedload movement
b) boulder groups provide better habitat response than single, random ones.

SUMMARY

Physical stream improvement structures have been used to restore, maintain and enhance fish habitat on a wide, though unsystematic scale throughout the United States and Canada over a long period of time. The literature on the subject is voluminous and sometimes contradictory. This form of stream habitat management appears to be most effective in increasing fish numbers when the structures simulate undercut banks, increase overhead cover, increase pool quality and create greater stream depth (White 1975); structures have been more effective in smaller streams and several may not be economically or physically practical for use in large rivers. However, some structures may work very well in large rivers. For example, large boulders placed as instream cover in major rivers in Wyoming (Wiley and Dufek 1980), Utah (Barton, Asce and Winter 1973)

and Montana (Lere 1982) have been proven effective in increasing trout standing crops. Data from boulder installations in the Crowsnest and Belly rivers in Alberta suggests similar results.

The key to the success of physical stream improvement as a part of stream habitat management appears to be in a basic approach to each stream. This approach can be summarized as follows:

1. What is the current habitat condition?
2. What was there naturally?
3. What is the desired habitat condition?
4. What fish species will benefit from improvement?
5. What occurs naturally that creates a desired habitat condition?
6. How can the natural condition be restored or duplicated?
7. What techniques are reasonable and practical to produce habitat?
8. How can the situation be evaluated and monitored to determine resource benefits?

The remainder of the presentation was based on a slide show which demonstrated aspects of stream habitat improvement structures used in South Dakota, Wyoming and Alberta.

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ARTIFICIAL PROPAGATION

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The Fish and Wildlife Policy for Alberta, (1982), provides government supported direction to the Fish and Wildlife Division. The Outdoor Recreation policy within this document states that the general goal of the Fish and Wildlife Division is to provide a variety of outdoor recreation opportunities based on Fish and Wildlife resources for the benefit and enjoyment of the citizens of Alberta. The Fisheries Policy goes on to state that the management of fish will be promoted on the basis of fundamental ecological principles.

Two goals of the Fisheries Branch (January 1983) are to manage the aquatic resources in the province to ensure that viable fish populations are maintained for the benefit and enjoyment of Albertans and to optimize the amount and variety of fishing opportunities for the recreational enjoyment of Albertans. These policies and goals give the Fisheries Branch a mandate, and direction for the wise management of the fisheries resources in the province.

The Status of the Fish and Wildlife Resource in Alberta (October 1984) reports on the current supply and long range population goals for trout in Alberta. Trout are the preferred fish, supplying about 2,200,000 days of recreation during which 2,000,000 trout were caught. About two-thirds of these trout were produced through natural reproduction in streams, and the remaining third were hatchery reared. The long range population goals are to increase all naturally reproducing trout populations to maximum production levels, and supplement the production with stocked trout. The goal is 3,000,000 harvestable trout by the year 2000. The real challenge to the Fish and Wildlife Division is to provide a supply for an increasing demand with a relatively finite natural reproducing resource, and physical and economic limitations to supplemental stocking.

Fisheries workers in Alberta go through a process of data collection in a wide variety of aquatic habitats. These range from very eutrophic prairie potholes in southeastern Alberta that are often marginal habitat for trout survival, to the fluctuating unproductive flowing waters in the eastern slopes. Once information is gathered, biologists go through a process of data analysis, interpretation, and conclusions that end with a set of trout management recommendations. Some of the management tools available to the Fish and Wildlife Division to achieve the stated goals and objectives include:

1. seasons or closures;
2. bag limits which includes zero limits or catch and release;
3. size limits which includes slot, minimum or maximum;
4. gear restriction, including no bait and flies only;
5. effective enforcement of the above;
6. public education to increase compliance;
7. mitigation of habitat losses;
8. reclamation, enhancement, or creation of trout habitat; and
9. the trout stocking program.

This presentation will focus on artificial propagation as a management tool, and will further focus on its' place in the east slopes streams, and lakes in the province.

Some objectives of the trout propagation program are to:

1. increase the supply of trout available to the angler;
2. provide the opportunity to catch trout in geographic portions of the province where none exist;
3. provide a variety of species to be caught;
4. introduce another species of trout into an existing lake or stream population, to establish a reproducing population of that species in those waters;
5. introduce a reproducing population of trout into lakes or streams that are devoid of fish; and

6. stock beaver dams and lakes where reproduction is not possible and which are commonly called put and take fisheries.

It is very important to refer again to the status document and restate the important role that natural reproducing trout populations play in providing recreational trout fishing (i.e., two-thirds of the supply) and that priority must be given to their maintenance in perpetuity. To me, priority means priority in fiscal allocation, priority in inventory and monitoring programs, and priority in establishing natural reproducing populations of trout.

The techniques available to achieve the previously stated objectives are basically the Divisions' Fish Culture program. Eggs for this program come from several sources, including the rainbow trout brood station near Caroline, and the Allison station near Blairmore that now produces brook trout and brown trout eggs. Natural reproducing wild stocks provide another source of eggs. For example, the spawning population of cutthroat trout at Job Lake has provided an adequate supply of cutthroat trout eggs for over a decade. River populations such as the brown trout in the Bow River can provide a source occasionally. Another source is the purchase of eggs from outside the province, however, diseases and Fish Health Regulations have limited this source recently.

A number of techniques have been introduced into the culture program over the last decade to increase production, but particularly efficiency. Electronic and computer advances have allowed the efficient control of feeding systems and monitoring water flow. Photo period is also controlled now.

Advances in filter systems and material shave facilitated advances in re-circulating systems which allowed for the fringe benefit of additional temperature control. Intake or recycled water is now treated with ultraviolet light, to reduce the possibility of disease introduction. Sperm storage and the use of extenders to increase the mobile time of sperm from a minute or two, to twenty, has increased the efficiency at this stage of the process. Not to be overlooked is the addition of a biologist to the culture staff to

provide a critical bridge between research and practical application into the Divisions' program.

The Sam Livingstone Hatchery in Calgary provides most of the Divisions' hatching, rearing and distribution capabilities. Egg-to-fingerling survival was increased in 1984 after the hatchery biologist reviewed egg collection and handling procedures and implemented improvements. Over the past decade, advances in equipment and communication systems have improved distribution. Larger trucks equipped with mobile telephones and specialized equipment such as ATV's and helicopters, plus trout bagged with oxygen have aided survival. Last year, trout rearing ponds were experimented with, but had limited success.

The Sundance Trout Rearing Station was acquired in 1983, and produced over 300,000 yearling trout from small fingerlings. This facility was contracted out to perform the same function for the 1985 season.

In 1984, the hatchery system produced 4,300,000 rainbow trout, 183,000 cutthroat trout, 305,000 eastern brook trout and 155,000 brown trout for a total of 4,943,000 trout.

The stocking of trout into Alberta streams and lakes dates back to the 1920's. The sites to be stocked have been the subject of many studies and discussions, sometimes controversial, probably because it was and still is not well understood by the parties involved. Miller (1952, 1954), Paetz (1961), and McDonald (1972), have studied the effectiveness of planting trout into Alberta streams, and found the returns to the creel to be very low. Studies in the United States including a study by Vincent (1975), showed similar results plus a negative effect upon the resident wild population of trout.

Fitch (1977) reviewed trout stocking in Alberta streams and concluded that if the stream will support a reproducing trout population, money would be better spent on habitat improvements than stocking programs.

At the present, the Fish and Wildlife Division stocks trout under the following general conditions:

1. Catchable trout in small lakes close to population concentrations even if they will not survive the winter (i.e., put and take);
2. Fingerling trout into small and medium sized lakes where they can survive most winters, but not reproduce (i.e., put, grow and take);
3. Beaver dams where trout can again survive all year but not reproduce. This program is relatively expensive for the number of trout planted and the dams must be easily accessible by the public;
4. Rivers that are barren of trout but have the habitat qualities to support reproducing populations year round. Examples of this type of introduction are cutthroat trout plants into the Ram Drainage in the 1950's, and more recently, introductions into the Upper Ram - Ranger Creek area and the Bighorn River above Crescent Falls; and
5. The introduction of a new species into a river system. This program must be carried out with extreme caution, as reproducing populations will be created and undesirable species should not be introduced. An example of this program is the Blackstone drainage where bull trout and mountain whitefish are indigenous. Bull trout numbers are low because of their limited capability to support angling pressure. With rapidly increasing demands for trout it was felt that a cutthroat trout population would be compatible with the native species, but provide additional angling satisfaction.

The stocking rates for streams are not well established. The Upper Ram - Ranger Creek introduction consisted of one planting of about 200 fingerling trout per kilometer. It took about 10 years to establish a fishable population. More recently we planted about 200 per kilometer of suitable habitat, for three consecutive years. The objective here was to establish the first three year classes, and accelerate the establishment of a reproducing population that could

in turn support a trout fishery. Very preliminary results suggest fishable populations can be created in about 5 years. This figure of 200 per kilometer is for a barren stream with a discharge of about 1 cubic meter per second and would have to be adjusted for larger streams or other species present.

I would like to conclude with some thoughts on what the future may hold in Alberta.

In the area of culture, I would not be surprised to see more use of hormones for ripening trout, particularly the males. Both genetic selection and genetic engineering may be used to produce a fast growing sterile population for use in put and take fisheries. Of course there will be continual advances in technology and procedures. I would expect increased production to meet the ever increasing demand for trout fishing.

In the area of stocking, I would expect some use of transplants of unique species such a bull trout and golden trout to recreate populations in the first case, or additional opportunities. With more knowledge of the native grayling, they could become increasingly important. I would expect a decrease in the area of planting barren waters, or species introductions, as there is a very finite amount that can be done. On the other hand, I can see more intense type management techniques used, such as the enhancement of spawning areas to create naturally reproducing populations. The work at Rawson Lake is about the first example. Other programs such as habitat loss mitigation, reclamation or enhancement will probably be more intensively applied to look after existing trout waters. Also regulations will have to become more restrictive, particularly with respect to harvest, to spread a generally limited resource amongst a rapidly increasing number of anglers.

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BIOLOGICAL STREAM IMPROVEMENT

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INTRODUCTION

This presentation is based on a report resulting from a two-year, biological stream enhancement project in Lynx Creek, Alberta, about 80 km west of Rocky Mountain House (Figure 1). The project was carried out under contract to the Alberta Fish and Game Association, with funds supplied by a grant from the Alberta Recreation Parks and Wildlife Foundation.

Field work on the Lynx Creek project was carried out during the summers of 1982 and 1983. It is important to emphasize that this project was not a study of stream biomass production. Rather, the project was based on some of the available literature and designed as an application of experimental treatments of relatively small sections of a typical high-elevation stream (1830m; 6000 ft.) in the foothills of the Rocky Mountains

The literature on experimental organic enrichment of streams (Warren et al, 1964; Mundie et al, 1973; Mundie, 1974) plus work carried out in Alberta strongly suggests that heterotrophic (secondary) production of bacteria and of invertebrates (largely insects) in streams relies heavily on organic carbon, either introduced experimentally (sucrose, leaves, cereal grain) or naturally leached into streams from surrounding land. The supply of organic matter (carbon) originates primarily from plant material produced by terrestrial vegetation, and is cycled into the stream by water, either as dissolved organic carbon or as particulate organic matter (leaf litter, etc.) carried by overland flow or by wind. Likens et al (1977) describe in detail the mechanisms involved and quantities of organic carbon passing through a forest stream. The

amount of carbon fixed by algae (diatoms) in streams in northern Alberta appears to be about 10 percent of the amount contributed by leaching and/or by movement of particulate matter, such as leaf litter (Charlton, 1980; Crowther and Lade, 1980).

The literature on heterotrophic (secondary) biomass production in streams reveals an extremely complex array of organisms which respond in varying ways and with varying inputs of energy and/or materials from outside the stream itself. Additionally, the autotrophic (primary) producers in streams (algae, diatoms, higher plants) which convert dissolved CO_2 to other, more complex materials during the photosynthetic process, rely on adequate light and temperature and chemical nutrients to maintain their population levels.

Initially, the development of the Lynx Creek stream enrichment project envisaged the use only of a source of organic carbon to enhance secondary productivity, with the general process being described as follows:

Organic carbon ⟶ Bacteria ⟶ Insects ⟶ Fish

Originally is also had been proposed that if increased production resulted from enrichment, that it be assessed quantitatively by measuring changes in production of various species of insects. More detailed examination of the problem revealed however, that to analyze and evaluate the response of stream invertebrates accurate to an order of magnitude (Hynes and Coleman, 1968) or to an even better level of accuracy (Crowther and Lade, 1980) would require detailed taxonomic examinations of insects far beyond the upper limit of available funds. The proposal was therefore modified to provide for identification only of a few of the most common insect orders (mayflies, stoneflies) and members of easily recognized families (midges, blackflies). From such analyses it was to be expected that at least the direction of expected changes could be related to experimental treatment. Stomach samples

from fish captured in the control and enriched sections were expected to reflect major differences which might occur in utilization by fish of the food organisms in the control and experimental sections of the stream.

The concept for the use of stream enrichment as a management tool is based on two experiments reported in the literature which resulted in dramatic increases in biomass production by several orders of magnitude. Warren et al (1964) enriched a relatively unproductive coastal stream only with sucrose to increase availability of organic carbon for enhancement of bacterial growth. Concentration of sucrose was maintained between 1.5 ppm and 5.0 ppm, with a subsequent increase in biomass (insects and fish) of approximately 7 times. Mundie (1974) reviewed the factors involved in the optimization of a salmonid nursery stream, and concluded that the most important were stream discharge, temperature, food production and cover. Earlier experimental work carried out in 1972 (Mundie, et. al., 1973) had shown that addition of cereal grain (wheat) to gravel increased both numbers and weight of aquatic insect larvae in experimental gravel containers in a coastal stream. Although Mundie used carefully standardized gravel in the experiments, results were variable, depending on date of introduction of grain, as well as the amounmt of grain used. Lowest increase of weight of insects in grain enriched gravel was 3.6 times that in unenriched gravel, and was in one case 30 times greater. Mundie suggested that increase of biomass in stream gravel probably was related to three factors: (1) amount of grain added to gravel (2) length of time grain was in the gravel (3) temperature of water, which in turn related to data of introduction. A third experiment, as yet unpublished (Slaney and Perrin, personal communication) involved enrichment of Keho River on Vancouver Island, British Columbia, with cereal grain and fertilizer (11-55-0). In this experiment, there was an almost immediate response to fertilizer addition and a slower response to addition of cereal grain (wheat). In both enriched sections young coho salmon and steelhead trout

showed a marked increase in growth over the summer period as compared to growth of the same species in unfertilized sections of Keho River.

The present experiment was designed to supply information on the feasibility of using experimental stream enrichment as a practical management tool, to increase trout production in streams in the Alberta foothills.

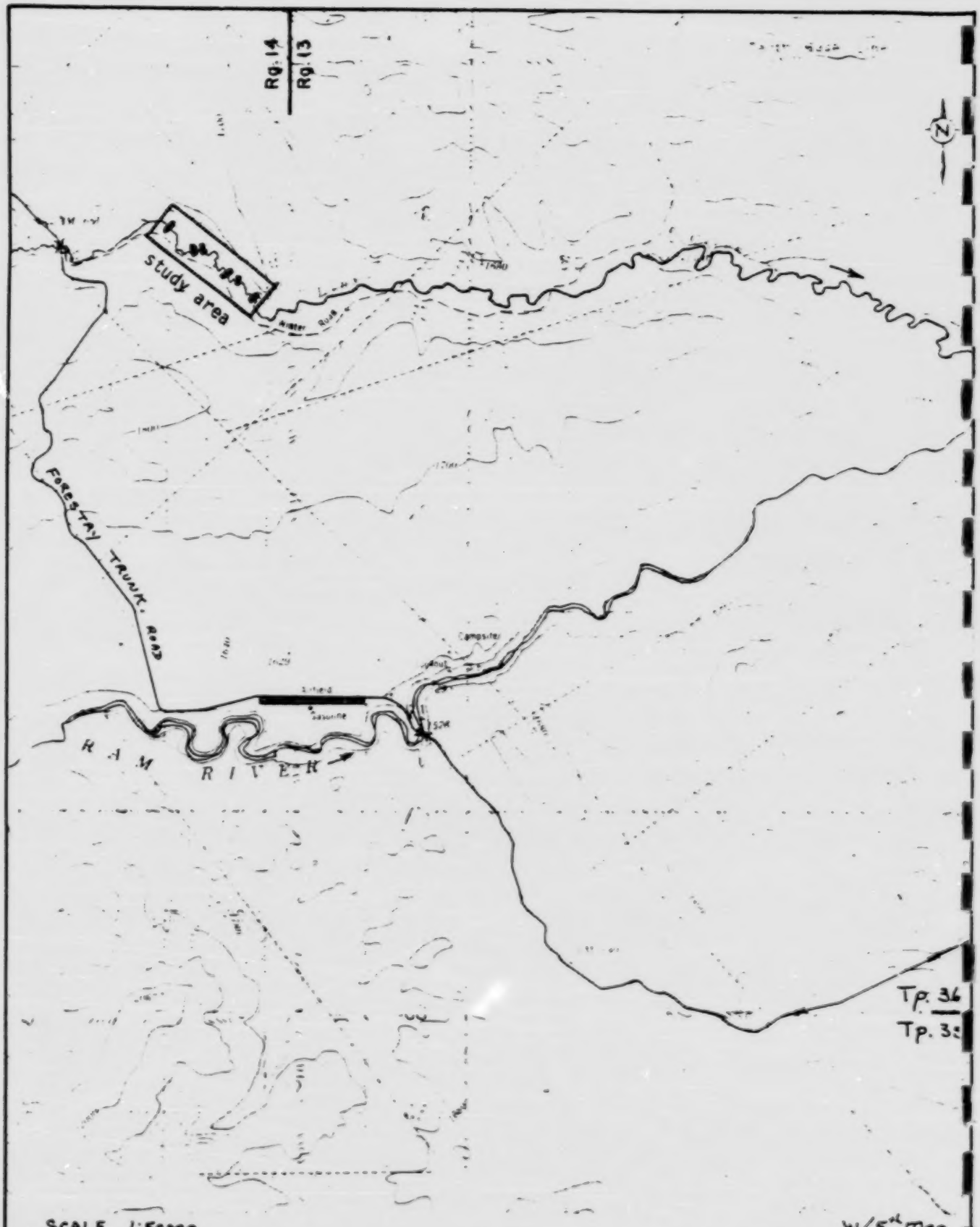

Figure 1. Lynx Creek, Alberta, showing orientation of the drainage basin to the Ram River and the Forestry Trunk Road. Fish fence locations are shown as heavy bars across Lynx Creek within the study area.

METHODS

Study Area

Lynx Creek, tributary to the Ram River, was chosen for experimental enrichment. The Lynx Creek drainage is relatively small (less than 10 km^2) and runs in an easterly direction for approximately 16 km (10 mi.) from its origin and drops from 2000 m (6,562 ft.) to 1500 m (4,921 ft.) where it joins the Ram River. The Lynx Creek drainage and its orientation to the Forestry Trunk Road and the Ram River is shown in Figure 1. A reach of Lynx Creek approximately 1600 m (1 mi.) in length with relatively uniform gradient and substrate was selected for experimental treatment. In this stretch of Lynx Creek the stream drops approximately 10 m (33 ft.) for an average gradient of about 0.65 percent.

Lynx Creek appears to be a stable stream, with little evidence of erosion, although a major freshet apparently occurred throughout the Ram River drainage following 24-hour heavy (15 cm) precipitation in July 1981 (Mel Kraft, personal communication), and may have severely reduced fish populations in the Ram River and its tributaries. The bottom substrate of Lynx Creek is made up of cobble, coarse and fine gravel and fines. No silt accumulation was observed, except in a few instances in the lower ends of pools with a depth of more than 1.0 metre. The cobble, gravel and fines are comprised entirely of fragments of sedimentary rocks of varying size. In one case where erosion had produced a steep sidewall on the outside of a bend in the creek, large slabs of sedimentary rock covered the stream bottom, to the exclusion of other sizes of cobble, gravel or fines.

The reach of Lynx Creek referred to above, and which appeared from visual inspection in 1982 to have uniform gradient, bank height and substrate was chosen as the experimental section. This reach was measured along its length and flagged at 25 m intervals with surveyor's tape. A control section of 475 m and two sections for enrichment each of 425 m were marked off. The control

section was furthest upstream, and was separated from the next downstream section to be enriched with grain by a buffer zone of 100 m. The lowermost section, to be enriched with fertilizer, was separated from the grain section by a buffer zone of 225 m. Each section was fenced on both the upstream and downstream ends by structures to prevent movement of fish into or out of experimental sections. In all, 6 fences were installed, consisting of vertical slot panels of 1" X 4" lumber resting at an angle of 60° on frames across the stream.

Substrates

During the first year of the Lynx Creek study (1982), experimental substrates were selected only by visual estimation of their composition. In the second year, a statistical analysis was employed to determine to composition of streambed particle size. These estimates are shown in Table I, which shows that the three experimental stream sections were essentially similar with respect to gravels, and that any differences in fish size would not be correlated with substrate differences.

Physical/Chemical Characteristics

Stream flow and water temperatures were recorded but are not included here. In such a short reach of stream, temperatures and flows as expected, were essentially identical in each experimental stream section. Stream flows between July and October, in both years generally were below 0.5 m^3/s and water temperature never rose above 10.5°C.

Detailed records were not kept of chemical constituents in Lynx Creek. However, water samples were taken on 30 June, 18-19 July and 31 July, 1982. Values for determination of N, P, TDS and conductivity are shown in Table I.

No substantial and consistent differences are apparent in chemical constituents between control and experimental sections of Lynx Creek. Variability in TDS from the concentration observed on 30 June to those on 18-19 June, and 31 July and 25 August probably reflect initially increased flow from snowmelt, with consequent

Table I. Concentrations (ppm) of NO_3 and NO_2 nitrogen, Kjeldahl nitrogen, total phosphorous, total dissolved solids, total suspended solids and conductivity in Lynx Creek, Alberta on 4 sampling dates in 1982.

Date	30 June	18-19 July			31 July			27 August		
Location	Site "A"	Cont.	Grain	Fert.	Cont.	Grain	Fert.	Cont.	Grain	Fert.
NO_3 & NO_2	0.05	0.03	0.03	0.03	0.04	0.03	0.02	0.005	0.005	0.005
TKN	0.34	0.90	2.20	1.60	0.25	0.25	0.26	0.30	0.50	0.50
TP	0.08	0.05	0.50	0.20	0.10	0.01	0.01	0.04	0.04	0.22
TDS	220	153	148	164	114	114	130	144	194	228
TSS	10	10	10	10	4.0	4.0	8.0	10	10	10
COND.	140	220	240	250	225	225	210	165	169	178

Symbols

NO_3 & NO_2 - nitrate and nitrite nitrogen

TKN - total Kjeldahl nitrogen

TP - total phosphorous

TDS - total dissolved solids

TSS - total suspended solids

COND. - Conductivity

dilution of dissolved solids, then a return to lower flows by 25 August, 1982. No explanation appears obvious for variability in N and P concentrations, but these may reflect stream discharge rate and/or variation in percolation of very shallow groundwater through or from dense vegetation mats on the stream banks.

Temperature, pH, turbidity and dissolved oxygen were determined for each of the three sections. These values appear consistent with what might be expected, with high dissolved oxygen values, low turbidity and pH near neutrality. These values are shown in Table I.

Experimental Treatments

In 1982, a control section and two experimental sections had been laid out in Lynx Creek and separated by fish fences to prevent movement of fish. Within these sections, invertebrate samples were taken and fish captured and tagged. In 1983, fences were installed at the 6 identical locations as those in 1982. In 1983, fences were installed on 23 June, but a record rainfall in a storm during the period 27-29 June resulted in destruction of all 6 fences. A series of heavy rainstorms occurred between 29 June and 15 July, and it was not until 23 July that flows in Lynx Creek had subsided to a level which permitted the re-installation of fences.

Both in 1982 and 1983 fish were captured in the control and enriched sections of Lynx Creek by use of a backpack, battery powered, 12 volt D.C., Type 7 Smith-Root fish shocker. Only 15 cutthroat trout were captured in initial sampling of 1.6 km of Lynx Creek in 1982 and only 22 in 1983. Because of low numbers of fish in Lynx Creek, a total of 91 cutthroat trout in 1982 from Onion, Joyce and Cripple creeks and 65 trout in 1983 from Onion Creek were transferred to the control and enriched sections of Lynx Creek. Data on these transfers are listed in Table II.

Table II. Stream of origin and means* of lengths and weights of cutthroat trout transferred to control and experimental sections of Lynx Creek, Alberta.

Stream of Origin	Transfer Destination: Control No.	Control F/L (mm)	Control Wt (g)	Grain No.	Grain F/L (mm)	Grain Wt (g)	Fertilizer No.	Fertilizer F/L (mm)	Fertilizer Wt (g)
Onion Creek	22			26			8		
Joyce Creek	7			0			10		
Cripple Creek	1	188.4		0	181.2		5	173.1	
Lynx Creek	0			4			8		

*All fish transferred to each section are lumped.

In 1982 individual fish were weighed, measured and tagged by affixing a small mammal tag (1mm X 2mm) to the posterior edge of the left opercle. In 1983 fish were not tagged because 1982 data indicated virtually no straying between stream sections. In 1982 bottom fauna were sampled twice (18 July and 2 October) at 5 replicate locations in each of the control and enriched sections of Lynx Creek. These samples were taken near the centre of the stream, with replicates progressing from downstream to upstream locations. No site was sampled twice, since it was possible to identify sites precisely from bank flag markers.

In 1982, fish and bottom fauna were sampled immediately after fish fences were installed, following which grain was spread in the experimental section below the control section, and fertilization was commenced in the furthest downstream section. In

the grain section, cracked wheat was spread at a rate of approximately 10g/m^2, and fertilization was carried out at a rate of 1.5 l per day, pumped as a saturated solution of 16-20-0 garden fertilizer. The pumping mechanism was comprised of a windshield-washer pump, powered by a 12-volt battery, to inject 150 ml of fluid into the stream 10 times daily, and timed by a 24-volt battery operated timer and "flip-flop" relay. Sludge in the liquid fertilizer container reduced the injection of fertilizer to such a rate that water-soluble liquid fertilizer with the formulation 10-34-0, and sold under the trade name of "TGreen Solution" was substituted. This product was obtained from Cascade Fertilizers of Standard, Alberta (Appendix 2). No further problems were encountered with fertilizer, a 50% solution of which was injected into Lynx Creek at a rate of 2.5 litres per day (250 ml X 10 times daily) from 25 July to 24 August, 1982.

In 1983 grain was spread in the experimental section below the control at a rate of approximately 20#g/m^2. Bottom fauna were not sampled, because a decision was made to measure response of invertebrates by means of drift samples taken at the 6 fences. In 1983 fertilizer was injected as in 1982, from 29 July to 6 September 1983, at a rate of 2.5 l per day.

RESULTS

Fish

A total of 106 cutthroat trout were captured, weighed, measured and tagged and comprised the pre-enrichment samples in 1982. These fish either originated in Lynx Creek or were transferred from other drainages, as discussed earlier. Numbers and weights and lengths of these fish in the control and experimental sections are shown in Table III.

Table III. Weights and lengths of cutthroat trout in control and experimental sections of Lynx Creek 18-19 July and 27-31 July, 1982.

Stream Section	No. of Fish	Mean Length (mm)	Mean Weight (g)
Control	36	179.0	82.0
Grain	35	175.7	83.8
Fertilizer	35	180.5	84.9

A comparison of the mean lengths and weights of all fish combined from each section of Lynx Creek in 1982 revealed that mean lengths and weights were not significantly different between sections (P less than 0.05). The assumption was therefore made that subsequent recaptures of tagged fish could be lumped with untagged fish captured on the same date, to provide larger samples from each of the stream sections. It had been observed that angling pressure was substantial on Lynx Creek, and that removal of tagged fish would likely reduce the probability of recapture of marked fish as the summer progressed. Fish captured before enrichment of the two experimental sections in 1982 (17-19 July), plus fish transferred to each of the sections (27-31 July), were considered to be the pre-enrichment samples (Table III).

Fish captured between 24 August, 1982 and 2 October, 1982 were considered to be the post-enrichment samples. Comparisons of increases in length and weight of fish sampled during the time periods referred to above are shown in Table IV.

Table IV. Lengths and weights of cutthroat trout from one control and two experimental sections in Lynx Creek, Alberta, 1982, before and after enrichment with grain and fertilizer.

Stream Section	Mean Length (mm)			Mean Weight (g)			Percent Change	
	Before	After	Diff.	Before	After	Diff.	Length	Weight
Control	179.0	197.0	18.0	82.0	99.4	17.4	10.1	21.2
Grain	175.7	208.8	33.1	83.8	115.1	31.3	18.8	37.4
Fertilizer	180.5	219.9	39.4	84.9	124.0	39.1	22.8	46.1

It may be seen from Table IV that in 1982 very large differences occurred both in lengths and weights of fish in the two enriched sections of Lynx Creek, as compared to the control section. Increases in length for the grain and fertilizer sections are respectively about 15 percent and 21 percent greater than those in the control section, while corresponding weight gains are 37.4 percent and 46.1 percent. These weights represent almost a two-fold difference for the grain and more than two-fold for the fertilizer section.

During the course of sampling fish from Lynx Creek in 1983, it was evident that fish fences were effective in preventing movement of fish between sections. Three tagged fish were recaptured outside the sections where they originally had been captured, but no further straying was observed. One fish, approximately 20 cm in length was found gilled on the downstream fence of the fertilizer section.

The lengths and weights of all samples of fish within each section of Lynx Creek were pooled in 1982, to provide a representative sample for that section. Originally it had been hoped to estimate changes in length and weight from marked recaptures only, but recapture numbers were so small as to preclude this possibility. In addition, the initial size at first sampling of recaptured trout was significantly higher than that of the total sample for that section. It is possible that a differential size-associated mortality occurred during sampling, but this is unlikely, because close inspection of the stream bottom and fences revealed no dead fish. From the data in Table IV, it may be seen that both weights and lengths of cutthroat trout were significantly larger in the grain and fertilizer sections than in the control, and that the weights and lengths of fish in the fertilizer section were significantly larger than in the grain section.

In order to minimize stress on fish and to reduce possible handling mortality, fish were not weighed or tagged during first sampling of Lynx Creek and transfer of fish from Onion Creek to Lynx Creek in 1983. Only lengths were determined before release of fish. Lengths of fish originating in Lynx Creek or transferred from Onion Creek in 1983 are shown in Table V. It may be seen from Table V that before enrichment in 1983, fish in the control section were significantly larger than fish in the grain and fertilizer section and those in the grain section were significantly larger than in the fertilizer section. The data for fish sampled on 28-29 July and 7 August, 1983 are summarized in Table V.

Table V. Mean lengths of cutthroat trout in three sections of Lynx Creek in (1983)*. Arrows show occurrence of significant differences between means.

Stream Section	No. of Fish	Mean Length (mm)	
Control	26	204.3	
Grain	28	187.5	P .01
Fertilizer	27	170.5	

* Combined samples captured in Lynx Creek and transferred to Lynx Creek from Onion Creek.

It is apparent from Table V that fish sampled from or transferred into the control and experimental sections of Lynx Creek on 27-29 July and 7 August, 1983 exhibited substantial differences in mean length, and that these differences were statistically significant. Subsequent sampling of Lynx Creek cutthroat trout on 1 October, 1983 resulted in the capture of much larger numbers of fish than anticipated, 125 of which were smaller than any of the 87 specimens captured 27-29 July, 1983 in Lynx Creek or transferred to Lynx Creek from Onion Creek on 7 August, 1983. Comparison of the length frequency of this group of trout with cutthroat trout from other parts of the Ram River system indicate that these fish very likely are II+ in age. They probably migrated into the experimental sections after the late July and early August sampling, since they would have been small enough (less than 100 mm in length) to pass through the fish fences.

Comparisons of pre-enrichment and post enrichment mean lengths of fish were confined to samples obtained from the combined number of fish either captured in Lynx Creek or transferred from Onion Creek. These data are listed in Table VI.

Table VI. Mean lengths of cutthroat trout before and after enrichment, from one control and two enriched sections of Lynx Creek and mean weights of cutthroat trout from the same sections, after enrichment in 1983. Arrows show were difference is significant (P less than 0.01).

Stream Section	Mean Length (mm) Before	After	Diff.	Mean Weight (gm) After	Percent Change in Length
Control	204.4	220.5	16.1	116.9	7.9
Grain	187.5	235.8	48.3	147.2	25.8
Fertilizer	170.5	224.5	54.0	142.5	31.7

When the data in Table VI for 1983 are compared with those in Table IV for 1982, it is apparent that results are very similar. Cutthroat trout in enriched sections responded in essentially the same fashion in 1983 as in 1982, although the percentage change in length in all sections was lower in 1983. Percentage difference however, in growth between control and enriched sections was higher in 1983 than in 1982. Order of magnitude in percent change in length from control to grain was 1.86 in 1982 and 3.27 in 1983. Similarly, order of magnitude in percent change in length from the control to fertilizer was 2.25 in 1982 and 4.01 in 1983.

Invertebrates

Invertebrates were sampled in Lynx Creek at 5 locations within each of the three stream sections in July, August and September, 1982. A Surber sampler was used to collect the benthic fauna, which were then preserved in 5% formalin for subsequent identification and analyses. A number of statistical comparisons of total weight of benthic macro-invertebrates were carried out before and after treatment of Lynx Creek in 1982.

Data on comparative total weights of invertebrates collected by Surber sample in Lynx Creek in July 1982 (pre-enrichment) and August and September, 1982 (post-enrichment) are shown in Table VII. Total biomass of benthic (bottom) fauna in Lynx Creek was found to be highly variable, a characteristic generally observed in samples of bottom organisms from streams. Nevertheless, it could be shown that the total invertebrate biomass in the section enriched with grain was significantly higher in August than in the control section about one month after initial treatment. By September (2 months after initial enrichment) benthic invertebrate biomass in control and grain sections were not significantly different. Although the benthic invertebrate biomass in the fertilizer section showed almost a three-fold increase following enrichment, at no time did it reach the levels observed in the control and grain sections, and on the last sampling date (about 2 months after initial enrichment) benthic invertebrate biomass was

Table VII. Total weights of benthic macroinvertebrates collected from each of the test sections in Lynx Creek during 1982. (Expressed as mg/Surber sample.)

Date	Test Section: Control $\bar{x}$	Control S.D.*	Grain $\bar{x}$	Grain S.D.	Fertilizer $\bar{x}$	Fertilizer S.D.	Statistical Test†	Multiple Pairwise Comparison Least → Greatest**
July	152.0	58.4	201.0	63.4	136.6	44.6	NS	
Aug.	289.2	96.6	680.4	373.4	387.6	123.2	S	C F G††
Sept.	568.0	242.0	462.0	61.2	377.0	14.7	S	F G C***

*$\bar{x}$ = mean; S.D. = standard deviation.

†Differences among all sites for each date were tested using Kruskal-Wallis test.
NS = means not significantly different among sites, $P > 0.05$.
S = at least one mean significantly different, $P \leq 0.05$.

**Horizontal lines connect sites that were not significantly different ($P > 0.05$) using the non-parametric multiple comparisons technique outlined in Conover (1980). Sites are listed from those with the least weight on the left, to those with the greatest weight on the right (based on mean ranks).

††The total biomass at the grain site is significantly higher than at the control site.

***The total biomass at the fertilized site is significantly less than at the control and grain sites.

significantly lower in the fertilizer section than in both the control and grain sections.

A second method of comparing invertebrate biomass in the three stream sections involved the multiple pair-wise comparison technique, using orders or families of invertebrates which could be most easily identified. From Table VIII it may be seen that in 7 out of 14 comparisons, the fertilized section had significantly different numbers and weights of organisms in the groups compared. Generally, the differences appear to reflect a shift in species composition following enrichment. No clear pattern can be seen in comparisons to have more midges and less mayflies, blackflies, stoneflies and earthworms in the fertilizer section than the grain or control sties.

A third comparison involved statistical analysis of the stomach contents of cutthroat trout from the three sections of Lynx Creek. Significant differences in numbers and weights of adult beetles in stomachs were demonstrated, with fish in the grain section having both larger numbers and weights of adult beetles in their stomachs than did fish in the control and fertilizer sections. Fish in the grain section also had a significantly larger weight of midge larvae and pupae in this stomachs than fish in the control and fertilizer sections (Table IX).

Table VIII. Multiple pairwise comparisons of numbers and weights of macroinvertebrates collected from the three stream sections in Lynx Creek during 1982.

Date	Taxa*	Method of Comparison	Least → Greatest**	Comments
July	Ephemeroptera	Numbers	F C G	The fertilized site had significantly fewer mayflies than the control and grain sites.
		Weight	F C G	The fertilized site had a significantly lower mayfly biomass than the control and grain sites.
	Chironomidae	Numbers	C G F	The fertilized site had significantly more midges than the control and grain sites.
		Weight	N.A.	No significant difference by weight.
	Simulidae	Numbers	F C G	The fertilized site had significantly fewer blackflies than the control and grain sites.
		Weight	F C G	The fertilized site had a significantly lower blackfly biomass than the control and grain sites.
Aug.	Oligochaeta	Numbers	C F G	The grain site had significantly more aquatic earthworms than the control and fertilizer sites.
		Weight	N.A.	No significant difference by weight.

.../continued

Table VIII. Continued.

Date	Taxa*	Method of Comparison	Least → Greatest**	Comments
Aug.	Plecoptera	Numbers	F C G	The fertilized site had significantly fewer stoneflies than the control and grain sites.
		Weight	N.A.	No significant difference by weight.
	Chironomidae	Numbers	N.A.	No significant differency by numbers.
		Weight	F C G	The grain site had a significantly higher chironomid biomass than the fertilized and control sites.
	Trichoptera	Numbers	N.A.	No significant differency by numbers.
		Weight	C G F	The biomass of caddisflies at the control site was significantly greater than at the fertilized site.
Sept.	Oligochaeta	Numbers	C F G	The grain site had significantly more aquatic earthworms than the control and fertilizer site.
		Weight	N.A.	No significant difference by weight.
	Ephemeroptera	Numbers	F G C	The fertilized site had significantly fewer mayflies than the control and grain sites.
		Weight	N.A.	No significant difference by weight.

.../continued

Table VIII. Continued.

Date	Taxa*	Method of Comparison	Least → Greatest**	Comments
Sept.	Chironomidae	Numbers	C F G	The control site had significantly fewer chironomids than the fertilized and grain sites.
		Weight	F C G	The biomass of chironomids at the fertilized site was significantly less than at the grain site.

*Only taxa that were found to have overall significantly different means using the Kruskal-Wallis test ($P \leq 0.10$) are considered here.

**Horizontal lines connect sites that were not significantly different ($P > 0.05$) using the non-parametric multiple comparisons technique outlined in Conover (1980). Sites are listed from those with the least number or weight on the left, to those with the greatest number or weight on the right (based on mean ranks).
F=Fertilizer
C=Control
G=Grain

Table IX. Multiple pairwise comparisons of stomach contents from cutthroat trout in three sections in Lynx Creek during 1982.

Date	Taxa*	Method	Least → Greatest**	Comments
Aug.	Coleoptera A	% Number	F C G	Fish in the grain section had significantly more beetles in their stomachs than did fish in the other sections.
		% Weight	F C G	Stomachs of fish in the grain section had a significantly larger weight of beetles than did fish stomachs in the other sections.
Oct.	Chironomidae L, P	% Weight	F C G	Chironomids made up a significantly larger proportion of the stomach contents in the grain section than in the other two sections.

*These three data sets were the only ones to exhibit an overall significant difference among sites using the Kruskal-Wallis test of differences among means ($P \leq 0.05$).
A=adult
L=larva
P=pupa

**Horizontal lines connect sections that were found to be not significantly different ($P > 0.05$) using the non-parametric multiple comparison technique described by Conover (1980). Sections are listed from those with the least number or weight on the left, to those with the greatest number or weight on the right (based on mean ranks).
F=Fertilizer
C=Control
G=Grain

Of the total of 23 comparisons carried out on bottom fauna in 1982 in Lynx Creek, significant differences were found in 14 cases. In all the comparisons, regardless of statistically significantly differences, the section enriched with grain showed the highest numbers or weights of invertebrates in 13 instances and the second highest in 3 comparisons. In 7 of 23 comparisons significant differences could not be shown, either in numbers or weights of bottom fauna. In 11 comparisons, the fertilizer section showed the lowest numbers and weights of organisms after enrichment, and in 3 cases were intermediate between control and grain.

As mentioned earlier, several major precipitation events in 1983, with consequent flood discharges on Lynx Creek, resulted in destruction in all 6 fish fences. This not only resulted in a delay of about 3 weeks in initial sampling and enrichment of the experimental sections, but also placed a severe strain on the budget for the project. Consequently, further sampling of bottom fauna was discarded, and limited invertebrate collection was carried out by sampling drift organisms on two dates only. Six drift samplers were employed at each fence site, in order to provide data on the comparability of drift in the control and experimental sections. Data for the two drift sampling dates are listed in Table X.

Table X. Numbers of drift organisms sampled at upper and lower fences of control and enrichment sections of Lynx Creek, Alberta in 1983. (Sampling periods from 2000 hr to 0800 hr on 18-19 July and 9-10 September)

Section	EPHEMEROPTERA (MAYFLIES)				CHIRONOMIDAE (MIDGES)			
	10-19 July		9-10 Sept.		18-19 July		9-10 Sept.	
Section	Upper Fence	Lower Fence	Upper Fence	Lower Fence	Upper Fence	Lower Fence	Upper Fence	Lower Fence
Control	42	26	142	116	90	67	5	4
Grain	34	10	77	120	55	10	7	9
Fertilizer	26	26	73	68	11	10	8	20

The data in Table X above represent the pooled samples from 6 samplers at each location. Significant differences could not be demonstrated in numbers of drift organisms between upper and lower fences in any section, indicating that input and output of drift for the organisms shown in Table X appeared to be roughly comparable, regardless of treatment. A shift in the composition of drift is indicated during the summer months, with mayflies increasing between two-fold and three-fold in all sections, and midges decreasing in most sections between 19 July and 10 September.

DISCUSSION

The enrichment of Lynx Creek in 1982 and 1983 with grain as a source of organic carbon to increase (heterothrophic) secondary production, and with inorganic fertilizer to increase (autotrophic) primary production resulted in statistically significant increases in growth of fish in enriched sections, as compared to that in the control section in both years. The absolute increase in length of cutthroat trout was substantial in both control and enriched sections of Lynx Creek, but the percentage increases in the enriched sections were between 1.86 and 4.01 times greater in enriched sections than in the control section. Results are similar to those reported by Warren et al (1986), Mundie et al (1973) and Slaney and Perrin (personal communication). Some significant differences occurred in 1982 samples of bottom fauna between control and enriched sections, as well as between enriched sections. No persistent pattern could be demonstrated in 1982 for differences between samples of bottom fauna or in analyses of stomach contents of trout. In 1983, drift samples from 6 locations did not show statistically different results. Although sampling in both years of both invertebrates and fish, was less intense than desirable, the clear-cut increases in fish growth in enriched sections, as compared to the control, leave no doubt as to the response of cutthroat trout to stream enrichment.

There is no reasonable explanation for the differences in fish growth in 1982 and 1983 and numbers and weights of invertebrates in 1982, except response to enrichment. Lack of differences in drift samples in 1983 are not easy to explain. However, the conditions in Lynx Creek in 1982 were quite different than in 1983. Spring breakup in 1982 was very late, and summer weather was generally dry. Spring breakup in 1983 was at least a month earlier, and the summer weather was cool, with frequent showers. Stream flows in Lynx Creek were considerably higher in 1983 than in 1982. It would be unwise to accept results of enrichment over such a short time span without strong reservations

concerning adequate data. The results in both years however, are encouraging, and in the direction to be expected from the published literature.

From its inception, the major objective of the Lynx Creek project was to demonstrate the feasibility of a practical method to increase biological productivity in trout streams. Results both in 1982 and 1983 are highly encouraging, and they were consistent in both years. Furthermore, it has been shown that cost of materials to enrich Lynx Creek was below $100.00/km, both in 1982 and 1983. For most trout streams similar to the size of Lynx Creek, cost of materials for enrichment should not be considered to be significant.

Mundie (1974) discusses the importance to young salmonids of drift organisms originating from the benthos in riffles. In 1982, drift was not measured, but fish in the stream could hardly have existed on much else but drift organisms, aside from adult terrestrial insects which may have fallen into the stream. Mundie has pointed out also that it cannot be expected that even very rough quantitative estimates of benthic stream productivity can be made. Notwithstanding the reservations expressed by Mundie, a method has been available for some time (Hynes and Coleman, 1968) to provide accuracy to an order of magnitude in measuring benthic production in streams. The so-called "Hynes method" uses size frequency determinations for calculating secondary production to measure production for benthic communities. Subsequent modifications (Mailton, 1969; Benke, 1979; Menzie, 1980) have increased the precision of the method to a significant degree. Generally, the method is used to estimate production of only a single benthic species, because of the information required on life histories before precision can be increased. The work by Crowther and Lade (1980) used detailed taxonomic organization of the benthic data to produce estimates of production by an entire benthic community, and should be further explored. Sufficient information was gathered during the Lynx Creek investigation to indicate that the methodology employed for enrichment of streams is practical and low in cost. In

order to obtain adequate information on the effects of enrichment of streams, either with organic or inorganic agements, a longer term, more comprehensive investigation would be required.

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SESSION III

WILDLIFE MANAGEMENT TECHNIQUES

CHAIRMAN: Mr. S.E. Stephansson

HABITAT EVALUATION TECHNIQUES IN ALBERTA

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1.0 INTRODUCTION

Wildlife research conducted for the purposes of the assessment of wildlife resources has, in past, largely been structured to provide population or species abundance information. This emphasis towards population-based studies has been evident at all levels of wildlife research, from site-specific impact assessments to large regional studies for species management. Generally, this species abundance data is used as the comparative variable to monitor short or long-term trends in animal numbers within an arbitrarily defined study area or management unit. However, for such an approach to be valid, one major study condition must be satisfied:

Abundance estimates must be precise and repeatable to ensure that changes in animal numbers are adequately detected. Unfortunately, all sampling techniques designed to estimate animal abundance are prone to biases and inaccuracies, particularly for animals with clumped distributions, migratory tendencies, and/or poor visibility (Caughley 1974, 1977; LeResche and Rausch 1974). Invariably, the only means of improving the accuracy and reliability of estimates is to increase sampling intensity, both on an area and frequency basis. Such an option becomes prohibitively and unrealistically expensive for large, heterogenous study areas.

For impact assessment purposes, studies utilizing species abundance data must meet two additional requirements. These are:

1. During the life of the study, factors other than the environmental perturbation in question should not be

contributing to changes in animal numbers. This condition may be satisfied for studies conducted over a short period of time (i.e., less than several months). However, as study length increases, confounding factors such as fluctuating predation or harvesting pressures, disease outbreaks, and normal demographic cycles have an increasing potential of contributing significantly to changes in animal abundance data. As a result, interpreting the cause of change in animal numbers becomes increasingly complex, requiring control plots for comparative analyses, and multivariate statistical techniques.

2. The study should permit the significance of changes in animal numbers to be assessed on a regional scale. Assuming that the first two conditions are satisfied, an impact assessment based on animal numbers is still faced with evaluating the significance of any detected change. Reduced animal numbers within a study area following project development may indicate actual animal loss, with an associated loss of regional productivity, or a simple displacement of animals to habitats outside of the study area, with no loss of net productivity, or both. In any event, each of these scenarios must be assessed on a regional basis. Even net loss in productivity may be of negligible significance if regional productivity is altered only slightly. Securing adequate population data on a regional basis to permit impact from the development to be evaluated meaningfully is both difficult and expensive, particularly in areas where few previous studies have been conducted.

It can be safely stated that, in the majority of studies, these above conditions are not rigidly satisfied, making the results of such studies somewhat questionable.

In recent years, and particularly in the U.S., there has been a shift away from population studies to more habitat-oriented ones for impact assessment purposes. This shift has largely occurred in response to the need for a more cost-effective and defensible method of providing a data base for before and after comparisons, particularly in these tighter economic times of reduced environmental budgets. However, the greater use of habitat-based studies has also been rationalized as follows:

> "Numbers of species and numbers of individuals often may change for unpredictable reasons but habitat potential remains unchanged. Because of its relative stability, it is this habitat potential which should be documented by the wildlife manager interested in ecologically valid impact assessment" (USFWS 1980).

This increased use of habitat-based studies has not been restricted to the rather site-specific and detailed level of impact assessment. In recent years, wildlife resource managers in various provincial and federal wildlife agencies have begun to explore the theme of broad ecological mapping for strategic planning and assessment of wildlife resources. Much of the progress in this area of study has resulted from the efforts of members of the Wildlife Working Group of the Canada Committee on Ecological Land Classification. The stated goal of the Working Group is "to encourage and facilitate the development of effective and standardized methodologies for wildlife habitat classification and evaluation, as well as to further the integration of wildlife values within an ecological land survey framework" (Stelfox and Ironside 1982).

Irregardless of the scale at which they are performed, habitat classification and evaluation systems are based on the assumption that certain measurable biophysical variables within any given unit of land are directly related to that area's potential to support a given wildlife species. In the case of reconnaissance inventory mapping at scales of 1:250,000 to 1:1,000,000, suitable predictive variables could include such broad biophysical parameters as general vegetation form, soil group, relief, regional climate and

even geologic parent material. For the purposes of impact assessments, more detailed predictive abilities are required since the wildlife-supporting capabilities of site-specific cover types or areas, rather than large, ecological units, are to be determined. Consequently, the variables used become more detailed in nature, and may include such measurements as forest canopy composition, forest canopy closure, densities of browse species, etc. In either situation, the relationships between habitat suitability and the habitat or biophysical variables considered of importance to the species are generally synthesized in habitat evaluation models. The development of such models permits the rapid conversion of biophysical measurements or conditions into an index of habitat suitability.

In this presentation, I will be discussing habitat evaluation models from two unrelated research programs currently being conducted in the province. The first program under the direction of Harry Stelfox of the Alberta Fish and Wildlife Division, is a regional overview assessment of wildlife resource status in Alberta. The second program, being conducted on a much more localized scale by LGL Limited for the Slave River Hydro Project study group, is an assessment of current wildlife capability along the Slave River in northern Alberta and southern N.W.T. In this discussion I hope to demonstrate the similarities and differences of habitat evaluation models developed for the assessment and mapping of habitat capabilities at grossly different scales.

2.0 PROVINCIAL HABITAT EVALUATION PROGRAM

Turning first to the provincial program, this broad overview assessment of wildlife resource status in the province will document in a general way, the current supply of populations and habitat for several priority wildlife species and species groups. Resource supply data, on a province-wide basis, is required for several reasons:

1. To enable the Associate Minister responsible for Public Lands and Wildlife to periodically declare the current

status of the wildlife resource as required under the Fish and Wildlife Policy for Alberta.

2. To facilitate the development of provincial wildlife management planning priorities and the rationalization of budget allocations.
3. To provide input to provincial strategic planning efforts directed towards identifying present and future wildlife supply/demand trends.
4. To provide a provincial perspective for the efficient sequencing and priorization of more detailed regional resource inventories and assessments in the future.

To permit the desired overview assessment to be conducted in a rational and consistent fashion throughout the province, an ecological land classification map of Alberta was first prepared at a scale of 1:1,000,000. This map identifies 12 major climatic zones or habitat regions (modified ecoregions of Strong and Leggat 1981), and 278 habitat subregions which were delineated on the basis of major physiographic and geomorphic landform features (Pedocan Land Evaluation Ltd. 1984). Information on current vegetation cover, land surface disturbance, landforms, aquatic forms, soils, moisture regimes and winter severity is presented for each habitat subregion.

Habitat suitability for many wildlife species can be correlated with major physical landscape features, such as those mentioned above, that contribute directly or indirectly to various habitat requirements. Examples include the importance of steeply-sloping landforms and valley complexes for deer in the Prairie and Parkland regions, and the importance of undulating ground moraine/wetland pothole complexes for waterfowl. Consequently, the initial step in evaluating the suitability of habitat subregions for priority wildlife species involved the identification of these landscape features considered to influence wildlife abundance and distribution to the greatest degree, based on known wildlife distributions and densities within the province and on a review of existing relevant wildlife literature. The relationships between these biophysical variables and the relative abundance of key wildlife species have

been incorporated into species/habitat relationship models, develop by IEC Beak Consultants Ltd. (1984) for Alberta Fish and Wildlife. These models permit the calculation of a species specific index of current habitat suitability for each of the subregions, based on the known biophysical conditions within these areas. Figure 1, the species habitat relationship model for beaver, developed by IEC Beak (1984), demonstrates the format and mechanics of the model. For the sake of brevity, only the fall/winter portion of this model has been presented. However, it should be noted that a spring/summer component does exist for the purposes of developing a year round index of suitability.

The majority of habitat evaluation models developed in recent years have been structured to assess an area's ability to provide two major life requisites for wildlife, these being cover and food. For some species, these two factors are so interrelated that only a single food/cover component is recognized by the model. Conversely, evaluation models may recognize more than one cover requirements for those species with different reproductive and escape cover needs. In the beaver model, thermal cover and food have been considered to be the limiting overwintering life requisites for this species. The bracketed values to the left of each life requisite represent weighting factors, which reflect the relative importance of each life requisite to the animal's overwintering survival. You will note that these factors sum to one.

The next level of the model represents those biophysical variables considered to influence the suitability of a given area for beaver to the greatest degree. Of the seven landscape or climatic features described on the habitat region/subregion maps, only aquatic form, landform and vegetation have been considered to significantly influence the thermal cover needs of the beaver, while vegetation, landform and relief class are the biophysical variables considered of importance for the provision of adequate food supplies. The values to the left of the variables are weighting factors, which reflect the relative importance of each variable in providing or influencing the supply of the particular life requisite in question.

FIGURE 1 SPECIES/HABITAT RELATIONSHIP MODEL FOR BEAVER

Season	Life Requisite		Biophysical Variable		Variable Ranking	
Fall/Winter Habitat Suitability	(0.6)	COVER	(0.60)	Aquatic form	(3)	Lower perennial streams
					(3)	Lakes
					(2)	Ponds
					(1)	Organic wetlands (bogs)
			(0.30)	Land form	(3)	Glacio-fluvial valley
					(2)	Ground moraine
					(1)	Lacustrine
					(0)	Bedrock
			(0.10)	Vegetation	(3)	Deciduous forest
					(2)	Coniferous dom. mixed forest
					(1)	Coniferous forest
					(0)	Cultivated
	(0.4)	FOOD	(0.70)	Vegetation	(3)	Deciduous forest
					(2)	Coniferous dom. mixed forest
					(1)	Coniferous forest
					(0)	Cultivated
			(0.25)	Land form	(3)	Glacio-fluvial valley
					(2)	Lacustrine
					(1)	Organic
					(0)	Bedrock
			(0.05)	Relief class	(3)	Moderate
					(3)	Low
					(2)	High
					(1)	Extreme

The third level of the model lists variable categories with rankings. Each biophysical variable described on the habitat region/subregion map, such as current vegetation cover, is broken down into fixed classification categories which identify, in a general way, the full range of conditions occurring in the province. A major component of each species/habitat relationship model is the ranking (on a scale of 0=inadequate to 3=best) of each classification category based on its relative value in contributing either directly or indirectly to a particular life requisite of the species. In the example presented, I have not listed all of the potential categories for each biophysical variable because of space limitations. However, a sufficient number and variety have been presented to demonstrate the scoring or ranking system.

To calculate a suitability value for cover, the variable category which best describes conditions within a given habitat subregion is selected for each biophysical variable being considered. The rank assigned to the selected category is then multiplied by the appropriate weighting factor for each variable, and these products are summed to provide an overall cover suitability value. A similar process is conducted for food.

The two life requisite values are subsequently aggregated using the appropriate weighting factors, to produce a seasonal habitat suitability value.

The variable rankings and aggregation weightings are entirely subjective, based upon available published research and expert knowledge relevant to the particular wildlife species and geographic area of concern. This knowledge is documented in the form of key habitat requirement summaries which are cited in support of the rationale used in structuring each model. Once the model itself is developed, it is applied to the attribute data base associated with the habitat subregions in a straight-forward, mechanistic fashion. The process lends itself to computer application and rapid trial and error experimentation in altering and refining variable rankings and aggregation weightings within the model.

3.0 SLAVE RIVER HABITAT EVALUATION PROGRAM

Turning next to the Slave River program, LGL Limited is currently conducting baseline investigations on habitat availability within the Slave River Hydro project study area for 13 key wildlife species common to the area. This program also involves the development of habitat evaluation models. However, because the predictive abilities of these models must be responsive at a site specific level, rather than on a broad regional basis, they differ from those of the Fish and Wildlife Division in several ways:

1. Discrete vegetation cover types and individual wetlands and riverine systems will be delineated within the study area and evaluated for habitat suitability, rather than the broad biophysical units considered for the provincial overview assessment. Mapping will be conducted at a scale of 1:30,000 to 1:50,000.
2. The habitat variables which have been considered of importance in assessment habitat suitability are, of necessity, detailed botanical or physical measurements, and not the more qualitative biophysical categories used for evaluating large, ecological units.

Other than these differences in the specificity of the data being used, the format and mechanics of these models have remained relatively similar to those of Fish and Wildlife. Using beaver as the example species once again, the model format has been summarized in Figure 2. Food and cover are again considered to be the major life requisites limiting beaver abundance, although, in this model, both have been weighted 1.0 in importance. With such a weighting system, the overall habitat suitability value for an area is considered to be either the food or cover value, whichever is less. This prevents a particular stream system with suitable cover conditions but lacking available food from receiving an inflated suitability rating based on cover alone.

The next level of the model represents the habitat factors considered most influential in providing adequate food and cover.

FIGURE 2 HABITAT EVALUATION MODEL - BEAVER

Season: Year Round

Life Req.	Important Habitat Factor	Measurable Habitat Variable	Habitat Variable Categories	Suit. Indices (SI)
(1.0) FOOD	Tree abundance	V_1- % closure of deciduous tree canopy	0%	0.0
			1-20%	0.2
			21-40%	0.6
			41-60%	1.0
			61-80%	0.8
			81-100%	0.6
	Tree size	V_2- % of deciduous trees with DBH less than 15 cm	0%	0.0
			1-20%	0.2
			21-40%	0.4
			41-60%	0.6
			61-80%	0.8
			81-100%	1.0
	Shrub abundance	V_3- % closure of deciduous shrub canopy	0%	0.0
			1-20%	0.2
			21-40%	0.7
			41-60%	1.0
			61-80%	0.9
			81-100%	0.8
	Shrub size	V_4- average height of deciduous shrub canopy	0-1 m	0.2
			1-2 m	0.6
			2+m	1.0
	Botanical composition of trees and shrubs	V_5- % of total tree and shrub canopy comprised of willow, alder aspen, or poplar	0%	0.3
			1-10%	0.4
			11-20%	0.6
			21-30%	0.7
			31-40%	0.8
			41-50%	0.9
			> 50%	1.0
	Food accessibility	V_6- bank height x bank slope	0-120	1.0
			130-170	0.5
			> 170	0.0

...continued

FIGURE 2 (Concluded)

Life Req.	Important Habitat Factor	Measurable Habitat Variable	Habitat Variable Categories	Suit. Indices (SI)
(1.0) COVER	Water level stability	V_7- waterbody category	- open system	0.3
			- closed system	0.7
			- tributary system	1.0
	Shoreline shelter	V_8- shoreline[a] development factor	-1.0	0.2
			1.1-1.5	0.3
			1.6-2.0	0.5
			2.1-2.5	0.7
			2.6-3.0	0.9
			> 3.0	1.0
	Shoreline shelter	V_9- shoreline[b] category	- outer river bank	0.2
			- outer island bank	0.6
			- inner river bank	0.8
			- inner island bank	1.0

a) V_8 to be used for large lakes only.

b) V_9 to be used for large rivers only.

N.B. Shoreline shelter is assumed to be optimum (i.e. 1.0) in small streams and lakes.

These factors were primarily identified from an extensive review of beaver literature generated from studies within northern North America, although for some species, the expertise of local hunters, trappers and researchers also played a role in factor selection.

In this model, the ability of an area to provide adequate food supplies was considered to be directly influenced by the abundance of deciduous trees and shrubs, modified to some degree by tree and shrub size. Because beavers demonstrate certain forage preferences, food abundance value is, in turn, modified by species composition. A measure of food accessibility provides a final modifier of food value. It should be noted that for each stream or waterbody being evaluated, vegetation conditions up to 100 m from the shoreline would be considered in the habitat assessment. This distance was selected, based on the reported foraging activities of beaver, which is generally restricted to within 100 m of the water's edge.

For cover, water level stability and shoreline shelter, particularly for larger lakes and rivers which are prone to wave action and/or current scour, were considered essential for providing suitable sites for lodge construction.

Each habitat factor has a corresponding measurable variable associated with it for evaluation purposes. For example, in the beaver model, tree abundance is measured by percentage tree canopy closure, rather than by some density measure. Similarly, shrub abundance is measured by shrub canopy closure. These measurable variables were selected, based on their ability to be evaluated in a cost effective manner, either from available air photos of the area, or from actual field measurements at sampling locations. The majority of vegetation measurements were, in fact, collected during summer, fall and winter field sessions at sampling stations located in representative stands of each of the major vegetation cover types.

Although not shown on Figure 2, weighting values are applied to each of the habitat factors, similar to the Fish and Wildlife models. While these values are at least partly designed to reflect the relative importance of each factor at providing the life requisite in question, they have not been structured to sum to one

for all species, as they have in the Fish and Wildlife models, largely because of increased modelling complexity at this level of detail. Because the mechanics of the beaver model are relatively complex and cannot be adequately addressed in this presentation, the weightings of each habitat factor have been purposely omitted to avoid confusion.

The third level of the model represents the habitat variable categories. These categories represent the range of habitat conditions which can be encountered in the study region or comparable geographic locations. Associated with each category is a ranking value, which reflects the suitability of each category at providing the life requisite in question. Suitability indices range in value from 0.0 to 1.0, rather than 0 to 3 as in the case of the Fish and Wildlife models. This minor modification was implemented to make our models more compatible with the software and data handling packages of the Habitat Evaluation Procedures program of the U.S. Fish and Wildlife Service (1980), a habitat-based program developed specifically for impact assessments.

4.0 SUMMARY

It has been the intent of this presentation to briefly introduce habitat evaluation systems currently being utilized in the province to provide an assessment of habitat potential and availability, both on a province-wide inventory level and on a more restricted, site-specific scale. It is recognized that habitat evaluation systems have several inherent problems including:

1. their predictive abilities are only as valid as the biological information used in their development; and
2. in some cases, factors other than habitat or biophysical conditions such as traditional behavioural patterns or human disturbance play a significant role in influencing animal abundance and distribution.

However, if these shortcomings are recognized and habitat evaluation systems are not taxed beyond their capability and if an

adequate program of model testing and validation can be implemented, habitat evaluation models can become important aids in the collection, synthesis, and analysis of the increasingly large and diverse quantities of information needed for wildlife management, land use planning and impact assessment.

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LAND RECLAMATION FOR WILDLIFE

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1.0 INTRODUCTION

Four major land uses are recognized as potential end use objectives for reclaimed land in Alberta: forestry, agriculture, recreation and wildlife. Until the past decade, however, only forestry and agricultural end uses were considered for reclamation in Alberta. Forestry was generally the predominant end use for reclamation sites within the mountain, foothills, boreal forest and some areas of the aspen parkland regions of the province, whereas agriculture was the predominant end use in the grassland and aspen parkland regions (Marshall 1983). It has become increasingly apparent, however, that wildlife habitat is a viable alternative end use for reclamation, particularly within the green zone of Alberta (Anderson and Markam 1980; Hardy and Associates Ltd. 1982; Green and Yonge 1984; Millson and Bondy 1984).

A number of factors have contributed to the recent recognition of the potential of reclamation for wildlife:

1. Revegetation technology is continually improving and there is now a broad data base available for use. This date base includes detailed information on propagation, planting and reclamation potential for grasses, legumes, herbs, shrubs and trees. Our increasing ability to construct plant communities now provides the opportunity to control the development of wildlife habitat;
2. Because of recent increases in public and government recognition of the economic, commercial and aesthetic importance of wildlife and wildlife-associated activ-

ities (Filion et al. 1983), there is increasing public and government support for reclamation to wildlife habitat;

3. Many aspects of reclamation of wildlife habitat can be readily integrated with other end uses (Millson and Bondy 1984). Development of wildlife habitat may even enhance, rather than conflict, with other end uses, particularly reclamation for forestry;
4. Because of the diverse habitat requirements of wildlife, reclamation of wildlife habitat can provide operators with a high degree of flexibility in the reclamation plan. This can be particularly helpful in achieving successful reclamation in areas where more conventional reclamation methods may be impractical; and,
5. Because some methods for reclamation of wildlife habitat require only minimal use of equipment and manpower and low material costs, reclamation of wildlife habitat often may be the most practical and cost effective end use for specific areas (Green and Yonge 1984).

Wildlife end uses in reclamation are often compatible with forestry and can be integrated with forestry reclamation (Barr Engineering Co. and Borovsky 1980; Dickson and Vance 1981; Proctor et al. 1983; Millson and Bondy 1984). In some cases, however, wildlife habitat may be the most appropriate objective for sites such as steep slopes, areas with unproductive soils, extreme micro-climates, rock outcrops and headwalls, many of which are notoriously difficult to stabilize and revegetate. Once these areas have been revegetated, it is unlikely that timber harvest (a forestry end use) or cultivation (an agricultural end use) would be desirable or practical. In these instances, wildlife end uses would provide operators with a practical reclamation alternative.

Other sites, such as overburden storage piles and open mine pits, which may require extensive site development to meet criteria for forestry or agricultural production, can often be reclaimed with only slight modification to benefit wildlife. Small areas,

where large scale forestry or agricultural end uses are impractical, are also ideal for reclamation to wildlife habitat. Disturbed areas of high traditional importance to wildlife, such as aquatic sites, bottom lands, riparian areas or special use areas for wildlife (e.g., wintering areas for elk), should be reclaimed for wildlife, regardless of the feasibility of other end uses.

Prior to 1975, wildlife managers and reclamation planners rarely took advantage of these opportunities, primarily because reclamation standards and regulations in Alberta have traditionally stressed forestry and agricultural end uses. Hence, reclamation planners were not fully aware of the option to reclaim wildlife habitat, nor willing to depart from the traditionally accepted end uses. Furthermore, the wildlife habitat option, if considered at all, was generally considered late in operational planning by which time the manpower, equipment and material requirements were often excessive (Harrison 1984).

In combination, the above factors have resulted in and still contribute to an under-utilization of the wildlife end use in reclamation. Few reclamation plans consider reclamation or enhancement of wildlife habitat as an integral component of the reclamation effort. And although wildlife concerns are frequently identified in the pre-development environmental impact assessments, few site development plans incorporate wildlife end uses as primary or secondary land use objectives for reclamation.

The growing data base of reclamation research and experience (Utah State University 1978; Wallis and Wershler 1979; Westar 1983; Green and Yonge 1984; Harrison 1984; Millson and Bondy 1984; Sims et al. 1984; Green et al. 1985) provides ample evidence that the technology is now available and that the climate is right for wider acceptance of wildlife end uses as alternative goals in reclamation.

2.0 CONCEPTUAL APPROACHES TO RECLAMATION OF WILDLIFE HABITAT

When attempting to reclaim or enhance wildlife habitat in a reclamation site, there are a number of factors that should be considered during planning and implementation. Prior to development,

there is a need to obtain adequate baseline information on wildlife uses and habitat in and adjacent to the proposed site. Pre-disturbance information on the abundance, distribution and diversity of wildlife, special wildlife uses, vegetation communities, interspersion of habitat types, water availability, and topography can provide a framework for development and reclamation plans (Barr Engineering Co. and Borovsky 1980; Dickson and Vance 1981; Proctor et al. 1983). For example, information on the abundance and diversity of wildlife can be used to determine the "target" wildlife species for reclamation. Similarly, information on vegetation and habitat interspersion can be used to select appropriate plant species for reclamation and design a landscape plan.

Successful enhancement of disturbed areas for wildlife must provide the basic requirements for food, water, cover, and range (Dickson and Vance 1981; Poston and Schmidt 1981; Proctor et al. 1983). Reclamation for wildlife should consider factors such as plant diversity, species composition and interspersion, habitat dispersion and edge habitats, water regime, proximity to water, and topography. In some cases, isolation from human disturbance may also be an important consideration. Generally, an area with a diversity of habitats is capable of supporting a greater variety of wildlife than areas with a limited number of plant communities. Diversity is the key to successful reclamation for wildlife, and reclamation for wildlife should maximize the diversity of habitat, topography and vegetation.

The primary objective of wildlife habitat reclamation should be to re-establish a diversity of self-sustaining plant communities that will benefit a variety of wildlife. Once these communities are established, natural ecological processes should be allowed to direct successional trends in the plant community.

Wildlife ecology and habitat use usually involve a complex array of interspecific and intraspecific relationships, thus methodologies for enhancement of wildlife habitat can also be complex. To simplify the objective of establishing a diversity of self-sustaining plant communities, we believe that reclamation of wildlife

habitat should be directed initially towards the rapid establishment of early seral plant communities that are of benefit, in the short term, to wildlife species adapted to early seral communities. There are several advantages to this approach:

1. Plant associations in early seral communities are generally simpler than in mid-seral or some mature plant communities, thus re-establishment of these communities is less complex;
2. The establishment of early seral communities is a realistic and attainable goal for reclamation, and thus, within a relatively short term, provides an opportunity to evaluate the wildlife enhancement program;
3. Early successional wildlife species are more likely to be attracted to reclamation areas than species adapted to more mature plant communities. Thus by encouraging recolonization by early successional species, re-establishment of wildlife will likely be promoted;
4. Because results of the reclamation program, evident through wildlife use, will be visible in a relatively short period (within 5 to 15 years), the company and its employees receive positive reinforcement for their efforts through visible success in enhancing wildlife habitat; and
5. Because results may be realized in a relatively short period, there can be a strong public relations benefit to the company through reclamation of early successional communities for wildlife.

Although the major focus of a wildlife enhancement program should be the establishment of early seral communities, methods which promote rapid succession towards mature plant communities are available and can be utilized where required.

3.0 THE CONCEPT OF KEY WILDLIFE SPECIES IN RECLAMATION

A large number of wildlife species may be present or potentially utilize reclamation areas and edge habitats around a site

(Verts 1959; Voight and Glenn-Lewin 1979; Whitmore 1980; Brenner et al. 1980). To design a reclamation plan for the direct benefit of all these species would be complex, inefficient and costly. In order to provide a clear conceptual framework for reclamation of wildlife habitat, we suggest that the reclamation plan be aimed at a small number of target or "key" wildlife species. By improving habitat for key species, several to many other wildlife species with similar habitat requirements would benefit. The key species approach therefore offers a means of simplifying the planning and implementation of wildlife habitat reclamation.

Because of the pivotal role of key species in designing and implementing a reclamation plan, they must be selected with care. Important criteria are:

1. they should be common to the area, both prior to and during site operation;
2. they should be adapted to or capable of using early successional habitats; and
3. they should be ecological generalists, with habitat requirements similar to other local wildlife species.

Wildlife species such as blue grouse (Dendragopus obscuras), mallard (Anas platyrhynchos), snowshoe hare (Lepus americanus), elk (Cervus elaphus) and moose (Alces alces) would be suitable key species, whereas species such as mountain caribou (Rangifer tarandus) or collared pika (Ochotona princeps) would be less suitable. Carnivores are also less suitable key species for reclamation than herbivores, because carnivore distributions are generally determined by their prey instead of vegetation parameters. As a result, it is difficult to directly reclaim for most carnivores.

4.0 WILDLIFE HABITAT RECLAMATION TECHNIQUES

In the following discussion of methods to reclaim wildlife habitat, it has been assumed that a stabilized growing medium suitable for the establishment of vegetation cover has or will be provided and that the propagation, planting and maintenance methodologies to establish self-sustaining tree, shrub and ground covers

are known. The techniques considered involve concepts of landscape design for wildlife which encompass the selection of appropriate topographic, hydrological and vegetative features and the juxtaposition of these features to maximize benefits to wildlife.

Reclamation techniques for wildlife can be grouped into four major categories: topographic modification, watershed re-establishment, revegetation and special supplementary measures. In reclaiming an area for wildlife habitat, this sequence would also be the logical order for implementation. Once the landform has been established, watercourses and waterbodies can be designed to compliment the natural land form. Revegetation can then be initiated to promote the development of vegetation communities suitable for specific microsite conditions. Additional supplementary features could also be incorporated to provide increased habitat diversity or specialized habitat features.

4.1 Topography and Contouring

Natural landforms generally contain a variety of topographic features that directly or indirectly affect wildlife. Slope steepness, aspect, shape and geological stability influence habitat edge and, in turn, influence habitat diversity and interspersion of vegetation communities (Thomas et al. 1979; Maser et al. 1979). Landforms directly influence wildlife through provision of escape terrain, protective cover, visual protection, or specialized habitats such as highwall, talus and south-facing wintering areas (Thomas et al. 1979; Tessman 1982; Proctor et al. 1983). Because materials movement and regrading associated with site operations results in the loss of most topographic relief and diversity, topographic modification should be implemented as a first step in almost all wildlife reclamation programs.

Some of the methods that have been used or proposed to increase and maintain landform diversity in reclaimed areas are:

1. Surface Re-contouring of Existing Slopes. The creation of rolling surface undulations on reclamation slopes provides a diversity of microsites in terms of exposures to climate, aspect, water/snow accumulation and

soil moisture which in turn promotes vegetation diversity. Free dumping of overburden (Westar 1983) and regrading of slopes to create small depressions and hills (Tessman 1982) have been utilized to create rough, rolling terrain.

2. Surface Depressions on Flat Terrain. Surface depressions serve a similar function to surface recontouring and can be created by excavation (Tessman 1982), explosive charges, or enhancement of existing mine features such as sub-grade access roads (WECO 1983).
3. Surface Roughening. Surface roughening is helpful in improving microsites and water retention. Discs and harrows can be used to roughen the land surface (e.g., Westar 1983) or specialized machinery can be used to gouge and dimple the land surface (Sindelar et al. 1973).
4. Specialized Shaping of Storage Piles. Spoil and overburden piles can be constructed in special shapes to promote topographic diversity and soil moisture regimes. A potential shape for construction of overburden piles is illustrated in Figure 1.

4.2 Watershed Re-Establishment

If reclamation areas are to provide adequate habitats for wildlife, self-sustaining water supplies must be available on or in close proximity to the reclamation site. Watershed enhancement for wildlife also can integrate with and improve watershed protection measures by reducing erosion, maintaining water quality and improving ground water supplies. Because several methods of watershed enhancement also improve fish habitat, fish eating mammals and birds as well as recreation may benefit. An exceptionally useful manual concerning watershed improvements for fish and wildlife was developed by Nelson et al. (1978). Methods of improving reclaimed watersheds for wildlife include:

1. Watercourse Reconstruction. Although most mine drainage structures are designed to efficiently

Figure 1. Contouring of overburden storage areas for wildlife habitat. Such a form provides a variety of slopes and aspects and, in turn, provides an increased diversity of wildlife habitats. (Source: Proctor et al. 1983)

transport water away from the site or to consolidation areas, these drainage systems can be enhanced for wildlife to provide a source of water, promote riparian tree and shrub growth, and modify the microclimate in the immediate vicinity (Tessman 1982). Preferred watercourse designs for wildlife should include convolutions to slow water velocities and provide a diversity of bank heights and shapes and deeper pools along most bends (Nelson et al. 1978). Stream banks can be stabilized utilizing rip-rap, gabion matting or other mechanical methods or by re-establishing riparian cover. Overhanging banks can be re-established using plants or log platforms (Figure 2) (Nelson et al. 1978; Wright 1984).

2. Creation of Waterbodies. During the operational phase of some industrial facilities, a variety of waterbodies or potential waterbodies such as sedimentation ponds, end pits or stock dams are formed. Assuming that the waterbody does not contain toxic leachates or effluents, they can be modified to greatly improve their value to wildlife. Waterbodies provide a ready source of water, sub-irrigation of shoreline areas, recharge of the ground water aquifer and promote development of emergent aquatic and riparian vegetation. Depending on the size, shape and depth of the waterbody, it can be developed as a lake, pond or wetland area. Reclamation of waterbodies for wildlife should provide a sufficiently impervious substrate to retain water, a fertile growth medium to promote establishment of aquatic vegetation, diverse bottom contours with variable slopes and depths, and a high shoreline complexity. The location should compliment the surrounding terrain and, if possible, have one or more inflows and an outflow to ensure stable water flows, and the recycling of water and nutrients.

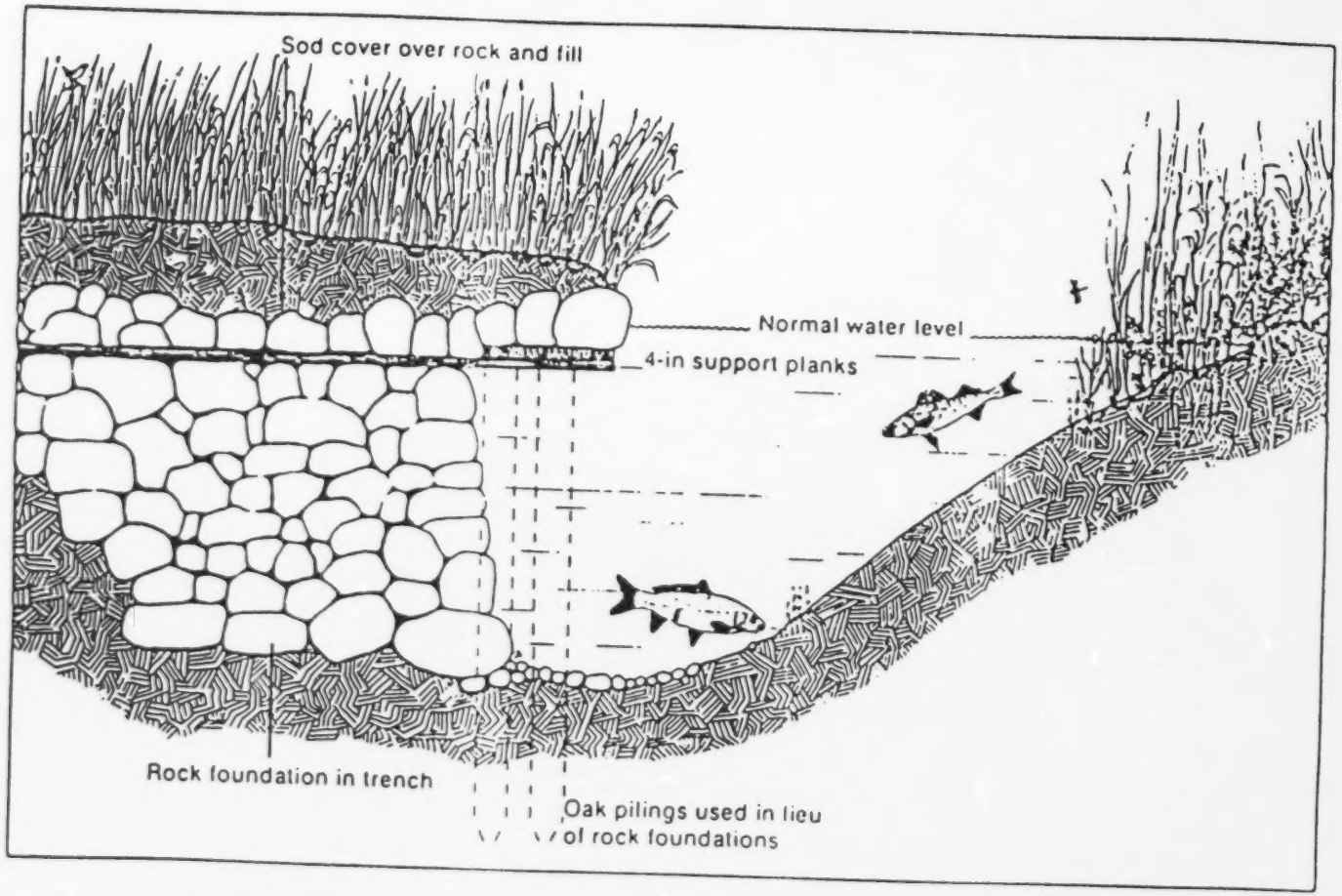
Sod cover over rock and fill
Normal water level
4-in support planks
Rock foundation in trench
Oak pilings used in lieu
of rock foundations

Figure 2. Reclamation of overhanging bank habitat in watercourses. (Source: Nelson et al. 1978)

3. Riparian Zones. Riparian zones are one of the most productive terrestrial habitats for wildlife and, in addition, help slow overland drainage and trap sediments and nutrients (Szafoni 1982). Moist to wet areas and seeps frequently develop as part of the drainage system within a mine and provide good locations to develop riparian vegetation.
4. Island Development. Small islands in lakes, ponds and wetlands can provide additional terrestrial-aquatic edge and littoral areas while providing good waterfowl nesting sites (Stoeker 1982). Islands can easily be constructed with rock fill or earth fill or by recontouring of the waterbody basin (e.g., separation of a peninsula from the mainland) prior to flooding. Artificial islands should generally be located in permanent water away from the mainland, be sheltered from the prevailing winds, and extend at least 1 m above high water to prevent erosion or flooding (Proctor et al. 1983). Size and shape requirements vary according to the species of wildlife and the site conditions.

4.3 Revegetation

Following development of the post-mining topography and watershed re-establishment, revegetation is the final and essential element in successful reclamation for wildlife. Revegetation for wildlife habitat must consider a wide variety of factors including seasonal habitat requirements of the key species, selection of palatable and unpalatable plant species appropriate for the key species and microsite conditions, successional patterns within communities, and spatial configurations of community blocks. Important revegetation concepts include:

1. Selection of Species. The relationship between the vegetation communities, their species composition and utilization of these species by wildlife is complex and not well understood, yet plant species selection is an essential element in the rehabilitation of land for

wildlife habitat. Animal preferences for plant species do not follow common methods of vegetation classification. Wildlife may use one group of plant species for food and another group of species for hiding or thermal cover; additional plant species may be important components of reproductive cover, or may provide a suitable source of moisture. Use of these vegetation groups also may be influenced by season or factors such as harassment by humans, natural predators and inter- and intra-specific competition. Choice of revegetation species must consider the habitat requirements of the key species, forage quality, palatability, rehabilitation potential of the selected plant species, and optimal mixes of preferred and unpreferred food species.

2. Plant Community Restoration. The success of a revegetation program in re-establishing wildlife habitat is largely dependent on the recognition of the physical constraints of the post-mine topography and hydrology on plant community development. Regardless of the perceived requirements of a key species for a particular habitat, we cannot provide that habitat unless the basic requirements of soil moisture, aspect, slope, and exposure are present. For example, if no steep south-to-southwest facing slopes with good wind exposure occur in a reclamation site, it is unlikely that some types of elk and deer winter range can be successfully re-created. Some potential locations for community development on an overburden storage pile are schematically illustrated in Figure 3.
3. Spatial Arrangement of Habitat Units. Many of the revegetation programs in Alberta have concentrated on reseeding of agronomic and/or mature ground covers to stabilize the soil and promote nutrient cycling and soil reconditioning. Tree plantings usually have involved only commercial timber species in stands con-

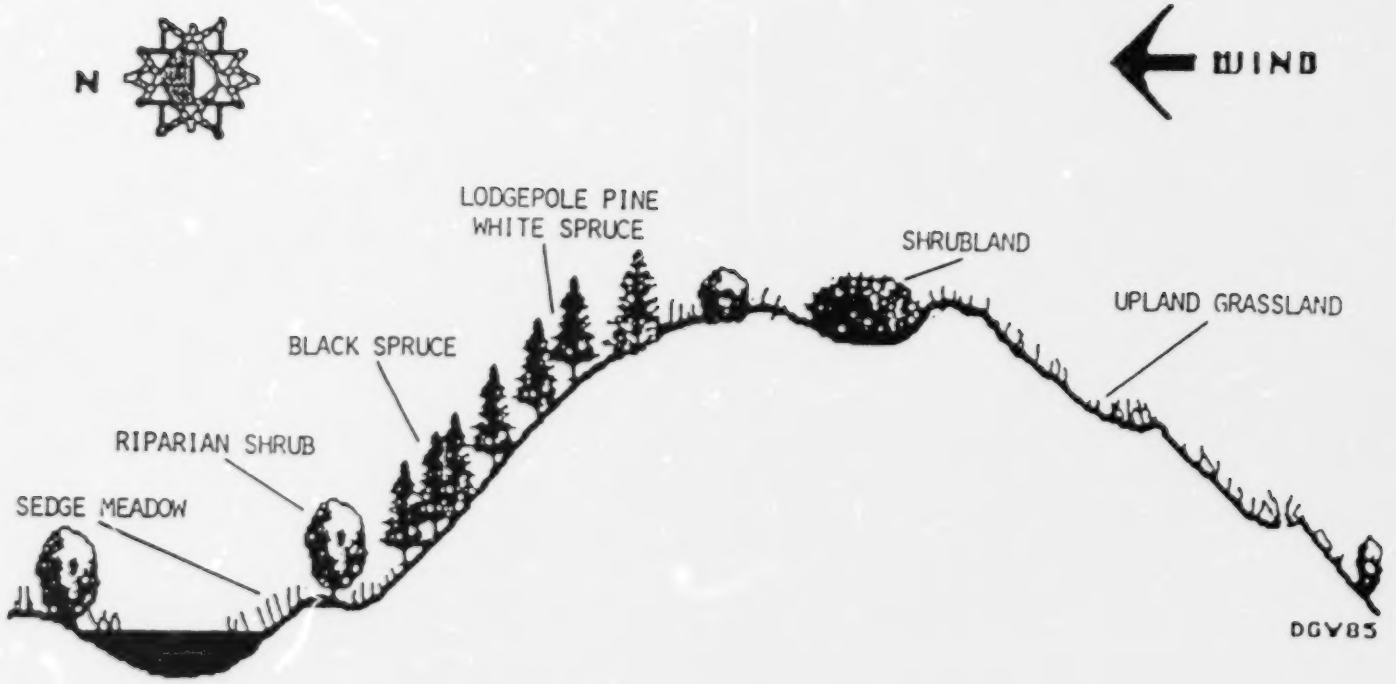

Figure 3. Potential locations for plant community establishment on an overburden stoage area. (Source: D. Walker)

sisting of one or several tree species. More recently, shrub clumps and intermixed community planting have been employed on a minor scale.

Clump or habitat unit plantings of wood species provide structural and floristic diversity, particularly when established in grassland areas (Westar 1983), and increase the amount of edge habitat. Careful interspersion and shaping of woody habitat units can promote wildlife movements into and through a reclamation area by providing hiding cover and travel corridors. Methods of establishing woody vegetation units include shrub clusters, topsoil islands, forest stringers, hedgerows, and transplants of natural vegetation islands. Data on the optimal spacing between these units is virtually lacking for Alberta. Wallis and Wershler (1979) suggested that tree islands within a reclamation site be spaced such that no island is more than 90 m from the undisturbed forest edge or an adjacent island. The 90 m distance, however, is derived from data for elk from the Blue Mountains of Oregon (Thomas et al. 1976) and is untested for the Alberta regime.

4. Planting Patterns Within Habitat Units. Because of the small number of examples and recent implementation of wildlife reclamation programs in this province and elsewhere, little information is available on optimal planting configurations for wildlife use. Within windbreaks or hedgerows, the core preferably should be comprised of coniferous and deciduous trees with shrubs of varying heights on either side of this central core (Figure 4). Optimal stocking ratios of shrubs and trees for wildlife are as yet poorly defined and will vary depending on the desired type of vegetation community. Plant spacing within a unit may also differ in

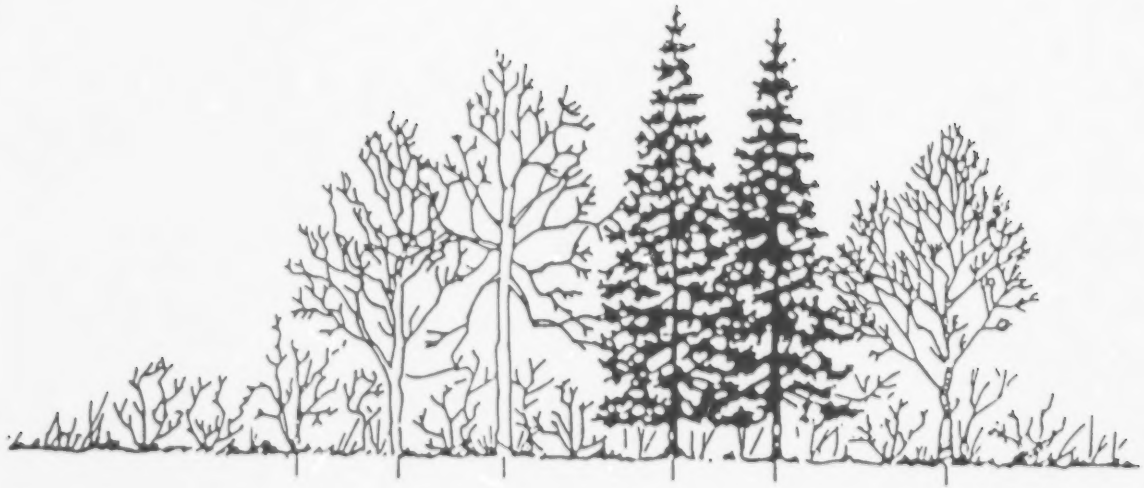

Figure 4. Schematic cross-section of a hedgerow or forest stringer. (Source: Polston and Schmidt 1981)

order to allow for increased protection from prevailing winds.

4.4 Special Structures

A variety of structures and techniques have been used to provide immediate improvements in structural and topographic diversity on wildlife habitat in disturbed areas. Methods that may be of value, depending on the site conditions, include enhancement of end cuts of high walls for raptors and some mammals, creation of rock talus, placement of rock piles or temporary brush piles, installation of snags and artificial nesting structures, and distribution of logs and stumps.

5.0 CONCLUSIONS

As shown by the few existing wildlife reclamation programs, it is possible and often desirable to integrate wildlife end uses with other land use objectives. Reclamation of wildlife habitat, whether it is a primary or secondary objective, can provide a reasonable, economic alternative for reclamation programs. In particular, wildlife habitat reclamation can often offer workable solutions for problem sites and can provide a degree of flexibility to most reclamation programs. From past experience, however, if reclamation methods for wildlife are to be effective and economic, they must be included at the initial reclamation planning stages, or ideally, in the preplanning stage of the site development plan.

There are numerous opportunities to incorporate wildlife end uses in reclamation areas, but until recently, many of these opportunities have been ignored. If wildlife end uses are to become a more common alternative in reclamation, reclamation planners need to consider more seriously the option for reclamation of wildlife habitat and the methods available to successfully reclaim areas for wildlife. Wildlife managers must work in close cooperation with reclamation planners to design landscapes that are attractive and useable by wildlife. Such landscapes are also likely to provide secondary benefits of recreational land uses.

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WILDLIFE POPULATION CENSUS

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The principle objective of wildlife managers is to ensure the maintenance of viable wildlife populations and their habitat.

My topic for discussion is big game population census techniques. Before describing presently available techniques and those in use in Alberta, I would like to reflect on the level of inventory precision required to meet the objective. Presently in Alberta, seven species of ungulates are managed for the purpose of supplying recreational hunting. Management of mountain goat, bighorn sheep, antelope and mule deer require a higher level of data precision than that required for elk. Moose and white-tailed deer require an even lower quality data base.

I mention this because it has a bearing on inventory intensity applied and technique used.

Wildlife censusing or population inventory programs got their start in 1952 after acquisition of our first wildlife biologist. Surveys at this time focused on high wildlife density locations and provided only historic density, distribution and trend information, of a general nature, for most of the large ungulates. Except for the antelope and sheep surveys, comprehensive surveys were not initiated until the Wildlife Service Unit was formed in 1971. Under the guidance of this group, provincial wildlife inventory programs were developed which applied a standard methodology. This methodology was carried out by trained staff complete with a central data storage system. During regionalization, the survey team was disbanded when the inventory responsibility were assigned to regional wildlife staff. To some degree this has lead to a disbanding of the standard methodology system.

The present thrust is once again to set up a standard methodology system whereby data will be collected and analyzed in a standardized method.

There are two main means of gathering information on status of ungulate populations. They are ground counts and aerial surveys. Ground counts are not used to any great degree other than in southern Alberta where it is not always possible to conduct aerial surveys because of poor aerial survey conditions Ground counts are usually conducted on foot or by vehicle for the purpose of obtaining reproduction and sex ratio information. Trend information is also gained when counts are conducted over the same area year after year.

Aerial surveys are the main means of collecting big game population data in Alberta. Depending on the information you are attempting to collect, there are a number of different survey methods available. The main types are, quadrant or block, transect, random quadrant, river or drainage, winter range, random sex ratio transect and a habitat stratification (habitat quadrant). Surveys conducted in this manner are designed to provide information on population density, reproduction, sex ratios, classified counts, distribution, habitat selection and trend.

Of the methods mentioned above the most frequently used today are the quadrant or block, the random quadrant, sex ratio transect, winter range and the habitat stratification quadrant.

The quadrant or block system normally consists of a series of 2.5 square kilometre (1 square mile) quadrants which are randomly selected from throughout the area to be inventoried. The blocks are flown in their entirety by means of a series of straight lines or by decreasing circles. Survey sites are normally plotted on aerial photographs or maps for navigational purposes.

Depending on the type of aircraft used and time of year, data gathered is density, reproduction, sex ratios, and habitat distribution for moose (deer and elk to a lesser degree).

Random quadrants are not normally square and may follow land forms, habitat types or river courses. Areas of these blocks must be calculated, otherwise procedure and information gathered is similar to the block survey.

Winter range surveys involve the flying of known winter ranges in their entirety. Surveys of this nature were developed and

refined through the use of distribution data. Data pertaining to reproduction, sex ratios, classified counts, density and distribution is collected for bighorn sheep, elk and antelope.

Sex ratio transects are conducted by flying a random transect pattern over a designated area for the purpose of gaining sex ratio and reproduction data on white-tailed and mule deer (can be adjusted for use in other species). The survey can be set up in such a manner as to gather information at a ±10% level. This normally means that 100 to 125 adult females have to be observed (all animal sightings are recorded).

Habitat stratification surveys involve the conducting of a quadrant survey of animals in an area where the habitat has been stratified into 3 or 4 classes. Stratification is based on the ability of the habitat to house the species to be censused. Once the areas or number of square kilometres for each class has been determined, a statistically valid quadrant survey can be set up which will direct survey effort toward the higher rated habitat types. it also supplies more accurate density data by stratified habitat type. White-tailed deer surveys flown within the parklands of Alberta are carried out using this technique.

Aerial surveys and ground counts are also the two main data gathering systems used to gather information on upland game bird populations in Alberta.

In Alberta, aerial surveys are used mainly for locating strutting and dancing grounds of sage grouse and sharp-tail grouse and wintering concentrations of pheasants.

Ground counts are the main means of gathering inventory information on upland birds. The main techniques presently being used in Alberta are flushing counts, dancing ground (including strutting grounds), crowing counts and drumming counts.

Flushing counts are conducted by establishing either transect lines or blocks in areas where the counts are to take place and are usually in habitat types utilized by the species being inventoried. The area is systematically transversed or in the case or production or brood counts a rambling transect can be utilized. In

all cases the amount of area to be covered must be agreed to before count is conducted. If to be repeated on a yearly basis, counts should be conducted at the same time each year.

Information gained by use of this technique is habitat preference (at that time of year), densities, sex ratios, and production (brood counts). This inventory works best on pheasants, Hungarian partridge, sharp-tail grouse, blue grouse and ducks (nest counts).

Dancing ground counts are carried out in the spring of the year during the breeding season by walking up to known dancing grounds or strutting grounds and flushing the birds. Counts of this nature are designed to record the number of males using the ground. Females are not counted because of the deviation in numbers of birds using the ground.

This type of population trend data enables the biologist to predict fall population levels for sharp-tail and sage grouse (in addition, to increase accuracy, brood counts should be conducted during July).

Dancing grounds can be located by following the sound created by the dancing males or by use of a low flying fix-wing (upper wing) aircraft early in the spring (snow cover is an asset).

Drumming and crowing counts are conducted along an established transect line with scheduled listening sites during the breeding season. Crowing or drumming audios are counted at each stop and yields data on relative density of male birds per stop and population trend. Inventory counts of this nature work best on pheasants and ruffed grouse.

Inventory programs relating to waterfowl consist of a series of aerial surveys conducted along established transect lines and flown at different times of the year for the purpose of obtaining pond index data, pair counts and brood counts. In Alberta the data collected pertains mainly to ducks and the surveys are carried out jointly by the United States Fish and Wildlife Service, the Canadian Wildlife Service and Alberta Fish and Wildlife.

Similar data are collected for the large Canada goose population of Alberta, with the addition of fall migration flights over a pre-established set of lakes in central Alberta being conducted to record migratory patterns and numbers.

Techniques for the future will be structured to meet goals of intensified wildlife management. As wildlife management becomes more precise, the precision level at which inventory data is collected will also be enhanced. There will likely be a move to manage on a reduced land base with habitat stratified surveys being conducted in order to increase the accuracy of the data base. For species such as bighorn sheep, the winter range surveys will continue to be conducted, as these inventories give us access to the greatest percentage of the populations while expending the least amount of effort. Antelope surveys will continue to be conducted as at present, with a move to increase their accuracy. Mule deer inventories will have to be upgraded and changed in order to meet increased level of management along with solving the problem of unpredictable survey conditions. There will likely be a move to combine ground inventories with aerial surveys in order to obtain the data precision required.

Connected to the inventory refinement will be a drive towards gaining a higher level of perfection in our harvest information, a topic I am sure Bill Wishart will be addressing next.

EVALUATING THE HARVEST

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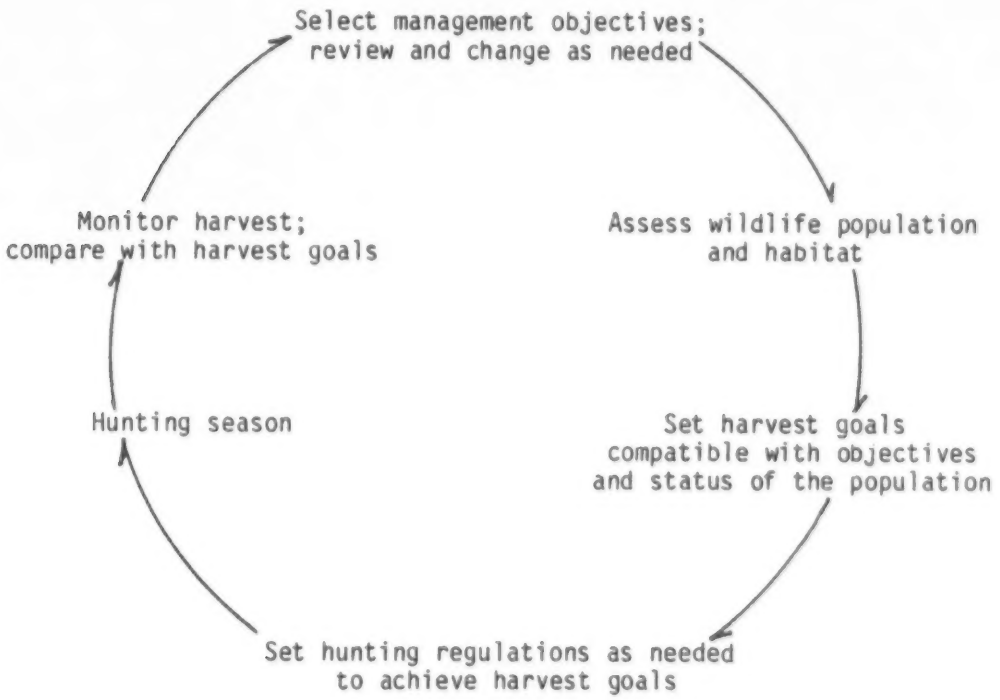
The annual cycle of monitoring wildlife populations and harvest usually follows the model described by Connolly (1981).


Select management objectives; review and change as needed
Assess wildlife population and habitat
Set harvest goals compatible with objectives and status of the population
Set hunting regulations as needed to achieve harvest goals
Hunting season
Monitor harvest; compare with harvest goals

Lauckhart (1950) believed that hunter management and public relations make wildlife population figures a virtual necessity, and furthermore, "the public does not trust wildlife managers who do not profess to know how many animals are available and how many should be killed." Today the real issue in wildlife management is not so much the numbers game as it is the habitat game. Most wildlife managers are busy directing their efforts toward the cornerstone of wildlife, i.e., habitat retention and improvement. Meanwhile, the annual process of animal production and harvest continues. This presentation deals with evaluating the harvest.

Harvest goals are usually developed from species management plans that outline an approximate habitat base from which an annual surplus of animals can be harvested. One of the cherished ideals of wildlife managers is that game animals can be cropped at some specified rate that will maintain populations at optimum carrying capacity. At this latitude, i.e., the northern fringe of the range of several species, it could be argued; since some species never reach carrying capacity because tough winters periodically sweep them away, there is no justification for a hunting season. On the other hand, one can take a pragmatic approach of professor Quimby from Montana State College who several years ago expressed how to harvest wildlife that are subject to the vagaries of unfavourable weather and natural cycles: "If you got em, shoot em!." That view generally makes sense where the average losses far exceed the harvest. The need for precision in establishing harvest goals is generally inverse to the numbers available. For example, in Alberta there are no harvest goals for cyclic upland birds, but there is a very restricted harvest goal for mountain goats.

In the case of cyclic upland species, harvest rates are a simple matter of raising the bag limit in peak years and reducing the bag limit in low years, i.e., allowing a bag limit (or setting par for the course) that can be reasonably attained by the hunter. In Alberta there is little regard for the actual numbers of ruffed grouse harvested, since hunters take only 5 to 10 percent of the estimated population (Paetkau 1984). Nevertheless, it is of interest to know that during peak grouse years, hunters harvest approximately 300,000 ruffed grouse and less than 100,000 during a cyclic trough.

One notable exception to the inverse rule is in waterfowl management. The continental harvest of waterfowl is sufficient to adversely affect several species, particularly in concert with declining habitat and drought. Thus, accurate harvest information is essential for negotiating inter-provincial and international agreements on bag limits. The scope of the waterfowl topic is beyond the limit of this presentation and rests largely within federal jurisdiction.

Where and when harvest estimates are used they are generally more reliable than population estimates. Also they are easier to measure. The most universal and generally least expensive system for obtaining harvest information is through a mail or telephone questionnaire. Sampling of big game hunters can vary from 2% (Wisconsin) to 100% (British Columbia) (Appendix 1). Questionnaire information suffers from variable response rates which bias success rates. These biases are overcome to some extent by sending a series of reminders (Alberta), introducing a mandatory report card (Washington) or taking away hunting privileges for a year from non-respondents (Nevada). An example of changing success rates based on response rate is with the non-trophy sheep questionnaire in Alberta. The success of the first response was approximately twice the success of non-respondents that had to be sent reminders.

Another shortcoming of questionnaires is the reporting biases of the hunters in recording the sex and estimated age of animals harvested, i.e., a tendency to report more adults than young and more males than females. Hunters also have a tendency to report that they were successful when they were part of successful hunting party even they were an unsuccessful component of the hunting party. How many times have you heard a hunter say, "We got one!" In order to overcome bias problems, some states have set up a network of check stations to supplement their questionnaires. In Wisconsin there are approximately 450 compulsory check stations distributed throughout the state for sampling the deer kill (Creed et al. 1984).

Check stations add an important dimension to harvest evaluation by providing a sample of the sex, age, reproductive status and general condition of a population. In combination with other population information, sex and age ratios can be used to estimate population numbers or predict trends. In Washington, the mule deer buck kill is used as a direct indicator of population size (Parsons 1976). It is assumed that there are 10 deer remaining for every buck harvested. That assumption is based on the work of Lauckhart (1950), who prepared a graph that showed the post hunt population could contain 7-20 deer for each buck killed depending on the fawn-doe and

buck-doe ratios. Connolly (1981) suggested Lauckhart's model is well worth using when data limitations preclude more sophisticated calculations. Creed et al. (1984) describes a more elaborate use of harvest data for calculating populations based on the complete sampling of deer harvested in selected management units. According to Creed et al. (1984) "the sex-age-kill method provides one of the best available indices to deer populations, especially in more heavily hunted units." In addition, they have used their kill information in combination with winter severity indices and are able to predict buck harvests within ± 10 percent.

Waterfowl and upland bird trends can be derived from the sex and age ratios of the harvest in combination with other population indices. For example:

Ad. Males + Ad. Females = Total Ad. x Juv. = Total Juv. Fall Pop.

A + B = C x Ratio = D ⟶ C + D

This method was applied to the Camp Wainwright sharp-tail study by using arena counts in the spring for the value C and multiplied by age ratios of birds shot in the fall. The method predicted 4 of 5 low production years and corresponding low hunter success rates. This formula for trends is easily applied to pheasants using crowing cock indices, spring sex ratios and age ratios from the fall harvest. The exercise is very instructive in showing the large annual turnover rate (60-90%) in upland birds.

Check stations are a valuable, but expensive source of harvest information. Alberta has elected to use compulsory registration for harvest information on the high demand/low supply species, i.e., cougar, elk, grizzly, goat and trophy sheep. In 1977 Alberta introduced an incisor bar program. Hunters are provided with special envelopes for returning through the mail incisor teeth of their big game kills. The incisor program is a voluntary system that originally provided a general impression of the age structure of big game species in Alberta. In recent years, the incisor program has been directed toward hunters with authorizations in order to obtain more specific information on species that require more intensive management, e.g., some moose and mule deer populations. Knowing the age

structure of a population can be very useful for measuring the impact of hunting. For example, mule deer are very vulnerable to hunting (Wishart 1985) and a general buck season in heavily hunted areas, like southern Alberta, results in a very steep age curve with approximately 60% of the harvest represented by yearling males (Treichel 1980). By introducing the 3 point law the age curve shifted almost precisely one age class to the right (Treichel 1983). Under further restrictions in some areas with male mule deer authorizations, approximately 50% of the harvest is greater than 3-years old at this writing. The different age structures can be transformed into approximate fall production and harvest option models as follows:

Fall production and harvest option models for maintaining a winter population of 100 mule deer. (Assume 1:1 sex ratio at birth, and one fawn survives per adult doe with no winter mortality. [Arrow ( ) indicates winter replacement after fall harvest]).

Strategy 1. No Restriction on Buck Size and Antlerless Authorization

Age	Bucks	Does	Fawns	
1*	~~25~~	25 ←	0	Harvest bucks:does
2		25 ←	25	(x) 1:1
3		~~25~~	25	50/150 = 33%

winter biomass 5.7 tons

* If this strategy was possible, some bucks would have to be taken after the breeding season.

Strategy 2. 3 Point Restriction and Antlerless Authorization

Age	Bucks	Does	Fawns	
1	17	17 ←	0	Harvest bucks:does:fawns
2	~~17~~	17	17	(x) 1 : 1 : 1
3		17 ←	17	50/150 = 33%
4		~~17~~	~~17~~	

winter biomass 6.4 tons

Strategy 3. Antlered Authorization and Antlerless Authorization

Age	Bucks	Does	Fawns	
1	10	10 ←	0	Harvest bucks:does:fawns
2	10	10 ←	10	(x) 1 : 1 : 1
3	10	10	10	40/140 = 29%
4	10	10	~~10~~	
5	~~10~~	~~10~~	~~10~~	

winter biomass 7.4 tons

Three obvious lessons from the foregoing harvest strategies are (1) it is possible to harvest at least as many antlerless deer as bucks without reducing the breeding population, (2) although the winter numbers are the same, the older the herd the more biomass (30%) has to be supported and, (3) the older the herd the more young have to die. Fortunately, in the first strategy and unfortunately in the other cases, mule deer hunters select against fawns and take a disproportionate number of adult does. In strategies 2 and 3, hunters would have to be encouraged to take fawns in the same manner as calf moose harvests are being promoted in Sweden, Ontario, Saskatchewan and British Columbia. One hunter group that is very selective for mule deer fawns are muzzle loaders, as was found at Camp Wainwright during antlerless mule deer seasons. Management schemes that are designed to take large trophy mule deer bucks may have to promote hunting by muzzle loaders to balance the harvest. Whitetail escape strategies do not provide hunters sufficient time to be selective and the antlerless cohorts appear to be harvested in proportion to their abundance (Wishart 1985).

Another form of hunter selection that confounds a harvest strategy occurs during non-trophy sheep seasons in Alberta when hunters select against lambs and yearlings and select for ewes without lambs. As a result, they remove a disproportionate number of non-productive two-year-olds. The management strategy for big-horns is to maintain the nursery herds in a young and productive state as

well as produce trophy (4/5 curl) rams in a manner similar to the following design:

Fall production and harvest model to maintain a winter herd of 100 bighorns (Wishart 1970).

Age	Rams	Ewes	Lambs	
1	10	10		
2	10	10		(↖) winter replacements
3	10	10	10	Harvest rams:ewes:lambs
4	10	10	10	(x) 1 : 1 : 1
5	~~10~~	~~10~~	~~10~~	30/130 = 23%

In theory, at least two non-trophy sheep could be taken for each trophy ram harvested. However, since hunters are selective against harvesting lambs, it is necessary to adjust the non-trophy permits downwards at least in proportion to the natural losses from lambs to 2-year-olds.

It appears that there are sufficient harvest evaluation techniques available for wildlife managers to assess the impact of hunting. The problem is in orchestrating a combination of cost effective techniques that will provide the required precision as the need arises. In the future, one step that Alberta should take to improve cost effectiveness and to expedite the evaluation of harvest information is to give each hunter a permanent identification number as is done in British Columbia. The game kill, in combination with population indices and age structure, are the most valuable tools we have in managing the harvest.

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Appendix I

SUMMARY OF PRESENT HARVEST MANAGEMENT INFORMATION PROGRAM
OF ALBERTA FISH AND WILDLIFE

Prepared by Jon Jorgenson and Janet Edmonds

Species	Sex	Type of Registration	When	Who	Information Collected	Compliance & Reliability
Goat	Male or female permit hunt.	Compulsory registration with return of incisor bar mandatory (visual inspection).	Annual.	All successful goat hunters (approx. 30-40).	Age, sex, date, location of kill, days spent hunting.	Assumed to be 100% compliance. Tooth compliance < 50%.
Antelope	Trophy males (permit basis).	Voluntary questionnaire return.	Annual.	All trophy antelope hunters (2,680 in 1983).	Did you hunt, how many days, successful?, date of kill.	Compliance rate 90% with reminders. Reliability good.
	Non-trophy males and females (permit basis).	Voluntary questionnaire return.	Annual.	All non-trophy permit holders (1,564 in 1983).	Did you hunt, how many days, successful?, date of kill.	Compliance rate 94% with reminders. Reliability good.
Moose	General male moose.	None.			Some information collected through questionnaire sent to authorization holders. Success rate?	Size of sample too small and too many biases involved to make information very reliable.
	Male moose authorizations.	Voluntary questionnaire return plus incisor bar.	Annual.	All holders of male moose authorizations (4,309 in 1983).	Did you hunt general moose as well? If so, where, success, how many days spent? Did you hunt in area authorization for? Success, age data.	Compliance rate ~60%. Biases unknown. Compliance rate for incisor bars is ~11%
	Antlerless moose authorizations.	Voluntary questionnaire return plus incisor bar.	Annual.	All holders of antlerless authorizations (1,621 in 1983).	Same as above.	Compliance rate ~60%. Biases unknown. Compliance (teeth) ~ 30%.

Species	Sex	Type of Registration	When	Who	Information Collected	Compliance & Reliability
White-tailed Deer	General male and female.	None.			Some information collected through questionnaires sent to authorization holders.	Sample size too small and too many biases involved to make data reliable.
	Male white-tail authorizations.	Voluntary questionnaire return.	Annual.	All holders of male white-tail authorization (163 in 1983).	Did you hunt, how long, success? Did you hunt general white-tail, where, how long, success?	Compliance rate ~ 80% with 2 reminders. Non-response bias unknown.
	Antlerless white-tail authorizations.	Voluntary questionnaire return.	Annual.	All holders of antlerless white-tail authorizations (4,417 in 1983).	Did you hunt, how long, success? Did you hunt general white-tail, where, how long, success?	Compliance rate ~ 90% with 2 reminders. Non-response bias unknown.
Bighorn Sheep	Trophy.	Compulsory registration with visual inspection.	Annual.	All successful hunters (~ 250).	Date and location of kill. Age and horn measurements.	Assumed to be 100%.
	Non-Trophy.	Voluntary questionnaire return plus incisor bar.	Annual.	All holders of non-trophy permits (~ 1,007 in (1983).	Did you hunt, success, sex of kill, number of days spent hunting, age information.	Incisor bar compliance ~50%. x of 80% over last 9 years with 2 reminders. Information reliable and accurate.

Species	Sex	Type of Registration	When	Who	Information Collected	Compliance & Reliability
Mule Deer	General male.	None.			Some information on general male harvest obtained from questionnaire sent out to antlerless permit holders.	Due to poor compliance information unreliable.
	Antlerless authorization.	Voluntary questionnaire return.	Annual.	All holders of antlerless permits (approx. 6,852 in 1983).	Did you hunt; did you hunt general mule deer in province and if so where, how many days did you hunt successful, sex, age (fawn), location of kill.	Compliance rate ~ 75%. Non-response bias unknown.
	Male authorizations.	Voluntary questionnaire return plus incisor bar.	Annual.	All holders of male authorizations (approx. 1,362 in 1983).	Did you hunt; did you hunt general mule deer in province and if so where, how many days did you hunt, successful, sex, age (fawn), location of kill.	Compliance rate ~75%. Non-response bias unknown. Incisor bar compliance about 15-20%.
Elk	Trophy or general male elk.	Compulsory registration and return of incisor bar mandatory (visual inspection).	Annual.	All successful male elk hunters (1,300).	Age, location, date, no. of points of harvested elk.	Compliance assumed 100% however accuracy of data in question. Calculated success rate lower than what is believed. Incisor bar compliance ~ 75%.
	Female elk authorizations	Compulsory registration with return of incisor bar mandatory (visual inspection).	Annual.	All successful antlerless elk hunters (~700).	Age, location, date of harvested antlerless elk.	Compliance assumed to be 100%. Incisor bar compliance about 70%.

SUMMARY OF HARVEST MANAGEMENT INFORMATION PROGRAMS IN OTHER JURISDICTIONS.

Province or State	Harvest Data Program	Effectiveness and Evaluation
British Columbia (1985)	- as of 1982 all hunters are issued a permanent ID #.	- one full time position required to maintain this file. - allows for cross-referencing all harvest data programs.
	1. Questionnaire system - mail out with 1 reminder - selected by species tags - 50% of all moose hunters - 100% of all goat, sheep, elk, grizzly bear, caribou and cougar hunters - 25% of all deer and black bear hunters ~ 100,000 questionnaires annually	- 50% to 75% response depending on species (deer and black bear are usually lowest) - information is rarely available in time to set seasons (can use first returned data to provide preliminary information)
	2. Compulsory Inspection (visual at all Fish and Wildlife Offices). - for grizzly bear, goat, sheep, caribou, cougar, and Vanc. Island wolf.	- good biological data and essentially 100% harvest sample - provides a check against questionnaire data
	3. Permit or Limited Entry Hunts (8 species involved). - 100% sample of all hunters receiving permits - use of mail out questionnaire (no reminder)	- 70% to 73% compliance.
	4. Harvest Card System - usually sent out to permit holders - request for biological samples i.e., teeth, uterus, lungs, etc. - samples requested vary by zone and year.	

Province or State	Harvest Data Program	Effectiveness and Evaluation
British Columbia (Continued)	5. Integrated System - presently being developed - a computer program and file to integrate all harvest data collection programs - will be set up to be accessible to users not familiar with computers	
Saskatchewan (1985)	- all big game hunters are surveyed - 25% sample size (~ 27,500) using a mail out questionnaire - voluntary - general license holders and permit holders sampled at same intensity - names obtained from previous year's hunter list - check stations are used a lot to provide standard biological and harvest data (very important for mule deer)	- in 1983 75% compliance $\bar{w}$ 1 reminder - usually 25%-30% - no check to determine accuracy of data - provides accurate data and some check against questionnaire information
Wisconsin (1983)	- >600,000 deer hunters harvest an average of 111,000 deer - 10,000 hunters (randomly chosen) are surveyed $\bar{w}$ a mail out questionnaire - voluntary return (no reminder) - provides hunting pressure information - all deer hunters must register at a check station (450 throughout the state) - at 70 stations 12,000-16,000 deer are examined for age - other data collected: sex, age (adult or fawn), license type, location of kill	- 50% to 60% compliance - felt to be good data as has been high consistency overtime - accurate data - large sample size

Province or State	Harvest Data Program	Effectiveness and Evaluation
Pennyslyvannia (1983)	- mandatory report card ($\bar{w}$ license) for all deer and bear hunters - check stations where ~10% of the deer kill (20,000) are examined for age, sex, location of kill, etc. - bear hunters must also register their carcass	- no information
Nevada (1983)	- all big game hunters surveyed by mandatory report card ($\bar{w}$ license) - loss of hunting privileges for 1 year - 90% to 95% compliance with 1 reminder	- no information - no information
Oregon (1983)	- random sample of all general licence big game hunters (selected from license sales) - 1 follow-up letter - all permit holders are surveyed by postcard questionnaire within 3 days of close of hunt - 1982 Total License Sale = 467,954 - 75,000 questionnaires mailed out - 34,401 reminders - Total Postage Cost = $22,500 - Total Program Cost = $61,477 or $1.25 per useable questionnaire	- sample size provides 2%-5% confidence limits statewide but much lower for management units $\bar{w}$ low harvest rates - 60% to 85% compliance - no evaluation program mentioned
Vermont (1983)	- mandatory reporting of all white-tailed deer and black bear harvested - 16 day deer season - opening weekend biologists operate voluntary check stations throughout the state (biological and harvest information)	- provides a 10% sample which is considered adequate

Province or State	Harvest Data Program	Effectiveness and Evaluation
Utah (1983)	- 30% (randomly selected) of all general licence holders are surveyed using a mailed questionnaire - questionnaires are mailed to all big game permit holders - 90% of all general elk licence holders are sent questionnaires w 1 reminder - questionnaires are compulsory but not enforced - check stations and road blocks are also used to collect biological data	- statewide data at this sample size has 2% confidence limits. - 65% to 85% compliance w 1 reminder - 50% return on each mailing
Montana (1983)	- all big game and bird hunters are surveyed - telephone survey for residents - mail survey for non-residents - 84,284 questionnaires completed by phone - total cost = $30,708 or 36¢/questionnaire	- by phone 100% response and 81% contact rate - by mail 55% response w no reminder and 69% with 1 reminder - felt phone survey was less biased than mail - less error in completing questionnaire - good public acceptance - more cost effective
Washington (1983)	- sample 10% of all hunters for all species using a general questionnaire - 30,000-35,000 questionnaires returned - report cards for deer and elk hunters are mandatory - questionnaire sent to all goat and sheep hunters	- 50% compliance (no follow-up) ∴ 5% sample size - 50% compliance - no information on quality of data - 85% to 87% compliance w 1 reminder

INTERCEPT FEEDING FOR DEER AND ELK

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INTRODUCTION

I have narrowed the scope of my topic somewhat from that shown in the symposium agenda. Rather than discuss intercept feeding as it might apply to all wildlife including, for example, waterfowl, I will restrict my presentation to the intercept feeding of deer and elk.

A brief description of the deer and elk resources in Manitoba and the problems that have arisen from their coexistence with agriculture are presented to show how the intercept feeding technique evolved.

The cost effectiveness and the various applications of this wildlife management technique are described as well as implications for supplemental and emergency feeding programs for big game.

The innovative and untiring efforts of conservation officers Brent Lees, Jim Giesbrecht, Bruce Pelechaty and Randy Wooniuk, and wildlife resource technicians Ian Milliken and Ken McPhail were instrumental in the development of intercept feeding of deer in Manitoba. My co-worker, Larry Bidlake, Regional Biologist, Brandon, also contributed significantly in the developmental stages. In recent years, conservation officer Gordon Johnstone has done much to develop intercept feeding as a technique to prevent elk from damaging stored hay.

THE DEER AND ELK RESOURCES IN MANITOBA

White-tailed deer immigrated to Manitoba at the turn of the century and have virtually displaced the indigenous mule deer.

Between 1900 and 1950 an ideal habitat configuration for white-tails evolved, along with agricultural development which resulted in an all time high deer population, probably exceeding some 200,000 animals. Since then deer numbers have fluctuated down to a low of about 30,000 after the winter of 1974, then rebounded in the late 1970's to post-winter populations of 90,000 to 100,000 deer. Deer numbers have remained at about that level since.

White-tails are the primary big game species in Manitoba. The 40,000 to 47,000 deer hunters generated almost double the licence revenue that is collectively generated from all other big game licences. Deer hunters take home 24,000 to 28,000 harvested deer annually.

Elk (Wapiti) in Manitoba number about 7,550 animals distributed among seven distinct herds. These herds are largely confined to isolated islands of habitat in Riding Mountain National Park (4,800), Duck Mountain (1,750), Spruce Woods (350), The Interlake (350), Porcupine Mountain (150), Red Deer River area (50), and North Interlake (100).

Elk are highly prized by Manitoba hunters and there is about a 3:1 subscription rate of applicants for the number of hunting licences available.

THE PROBLEM

The primary deer range in Manitoba is co-terminus with the agricultural zone of the province. In fact, almost half of the 69,000 square miles of deer range in Manitoba is privately owned farmland. These private farmlands produce about 60 to 70 percent of the deer herd and its harvest. In the last two decades, almost one half of the bush cover has been lost from the farmland deer range. Attrition is continuing at a rate of about four percent per year.

In an attempt to combat this attrition of winter cover for deer, the Manitoba Wildlife Branch took advantage of federal-provincial cost shared funding in the early 1970's to purchase and designate strategic winter deer habitat as wildlife management areas

(W.M.A.'s). Scattered parcels of crown lands formerly used for local school revenues were also designated as W.M.A.'s. Many of these small areas of crown land are, in effect, islands of wooded cover in a sea of cultivated land. Similarly, the elk herds and their habitats are surrounded by farmland.

Some deer and elk have always sought out stack yards, but usually only during severe winter weather. In the last decade, however, habitat loss (which has concentrated deer), together with the increased use of high quality alfalfa for livestock feed, has made deer and elk damage to stored forage an annual problem.

This was the scenario in 1974 when habitat deterioration, heavy hunting pressure and winter deer losses depressed the deer population to the point where there was a general outcry to stop sport hunting. The deer season remained closed for 1974, 1975 and 1976. During that time, the release from hunting mortality, together with mild winter weather resulted in a dramatic resurgence of deer numbers; from a low of 30,000 deer after the 1974 winter to 90,000 - 100,000 after the winter of 1976.

This resurgence in deer numbers in turn resulted in a dramatic increase in damage to stored forage. In particular, farmers became incensed when deer from nearby "wintering areas" on wildlife management areas descend on their bale stacks at the first signs of winter. Similarly, elk in winter gravitate from the interior of their islands of habitat to the fringes where forest lands interface with farmland. It is there that they cause damage to bale stocks as well as fences. All of this resulted in heated calls from irate farmers for the government to keep "their deer and elk" on their own land and to help in preventing damage to stored livestock forage. Political pressure was applied to stop further designation of wildlife management areas.

THE GOVERNMENT RESPONDS TO BIG GAME DAMAGE COMPLAINTS

In response to these complaints from farmers, Manitoba, in 1974, developed a big game damage compensation program to pay farmers

for damage inflicted by deer, elk, moose and black bears.

The Department of Natural Resources (D.N.R.) also pledged to help farmers prevent damage by big game species in much the same way as waterfowl crop damage prevention was applied. Farmers prefer preventive measures because damage compensation is after the fact and does not help them solve the immediate problem of damage to property or stored forage.

Conservation officers used propane bangers, scarecrows, and a repellent called bloodmeal (a packing house by-product) but both deer and elk often overcame their fear enough to ignore these devices and continue their decimation of local haystacks. Temporary barriers made out of snow fence were also used, with some success. Similar to scaring ducks from one field to another, all of these damage prevention techniques simply moved problem deer from one farmer's baleyard to his neighbour's farm down the road.

DEVELOPMENT OF THE INTERCEPT FEEDING TECHNIQUE

It became clear that department staff needed to apply something like the waterfowl lure crop technique to the deer and elk damage problem.

About that time (late 1970's), through my association with an informal corps of Deer Managers and Researchers from Ontario, Michigan, Minnesota and Wisconsin (Great Lakes Deer Group), I learned of some long-term studies on the supplemental feeding of a captive white-tailed deer herd in Michigan. John Ozoga and Lou Verme of the Michigan Department of Natural Resources were good enough to release to me a preliminary write-up on their findings which they later published in the Journal of Wildlife Management. That information, together with literature and advice from Dr. Pat Karns of the Minnesota Department of Natural Resources, prompted us to experiment with the use of a commercially prepared deer ration in an attempt to lure deer away from farm forage stacks.

The experiment began by placing small, wooden, calf-type livestock feeders filled with a commercially-produced pelleted deer

ration on the 10 square mile Lauder Sandhills W.M.A. and on a section of crown land near the village of Hargrave. Deer from both areas habitually damaged haystacks of the neighbouring farms. The objective was to entice deer to stay on these crown lands during the winter rather than move out to nearby farmyards for easy access to stored hay.

During the winters of 1978 and 1979 we demonstrated that deer could be enticed into remaining on a relatively small parcel of crown land through intercept feeding. In those first few trials, we managed to over-winter 100 deer on one square mile of habitat with no damage to farm bale stacks immediately adjacent to the property. Incidentally, winter deer losses on that parcel of land were in the 5% range, whereas nearby habitats of like quality and size showed losses in the 15 to 20 percent range.

For the first time in over a decade, deer from the Lauder Sandhills W.M.A. were prevented from damaging the hay stacks of local farmer and Municipal Councillor John Martins, an outspoken critic of the W.M.A. program.

In fact, we found that most bale stack damage could be averted if the farmer was prompt in reporting deer damage and action was taken before feeding patterns were established. That action usually involves treatment of the periphery of the stack with a deer repellent such as bloodmeal. Then a strategically placed intercept feeder filled with pelleted deer ration is used as an alternative source of feed. Large round bales or loaf bales of alfalfa also serve the same purpose. It is important to place this alternative food source in a sheltered location on the incoming deer trail near the stack. The situation must be closely monitored and adjustments made until the deer have established a pattern for using the intercept food source.

Deer were easily kept in their home range habitat on W.M.A.'s in succeeding winters once they became accustomed to being fed there during the first year. We learned to move feeding sites a bit each year to prevent habitat damage in the immediate area and to avoid soil contamination that might lead to disease outbreak.

The response from the farming community was immediate and clear. The Wildlife Branch was finally seen as "doing something to manage deer on their own land". Most local Municipal Councils "eased-off" their antagonism to Wildlife Management Areas and have, in fact, sanctioned the designation of additional wildlife areas since that time.

COST EFFECTIVENESS

In Manitoba the average claim in 1984/85 for hay damaged by deer or elk is about $950.00. In the Virden D.N.R. district, officers responded to 67 complaints of deer damage to stored forage during the winter of 1984/85. These complaints involved an estimated 975 deer or about 15 deer per complaint. Officers used 41,450 kg of pelleted deer ration at $0.19/kg, 24 large round bales of $45.00 per bale, 2,775 kg of bloodmeal at $0.39/kg and $4,330.00 of vehicle mileage costs in dealing with these 67 damage complaints. The average cost per complaint was about $215.00. Even during the mild winter of 1983/84, average damage claims were $450.00. These data show that intercept feeding to prevent deer damage to stored forage is cost effective. The benefit/cost ratios have ranged from 2:1 up to 4:1 since we began using intercept feeding to prevent deer damage to hay. In addition, the public relations value is inestimable.

Elk damage to hay in the Swan River Valley bordering the Duck Mountain elk range was also a serious problem in the winter of 1984/85.

In response to 16 complaints, intercept feeding was undertaken as a preventative measure to thwart an estimated 520 elk from consuming livestock forage that was in short supply due to the prairie drought in 1984. The cost of this intercept feeding program was $14,588 or about $912.00 per complaint. The livestock feed shortage was so critical that the government had no choice but to take action to prevent elk damage. The result was that local farmers were pleased with the department's response, and threats of shooting elk to save hay abated quickly.

The cost of an agricultural community that is hostile toward wildlife and their habitats is one which virtually no wildlife management agency in the prairie provinces can afford or tolerate.

In previous years, conservation officers have routinely responded to damage complaints but that response often ended in frustration for both the farmer and the officer. Intercept feeding has provided the officer with a valuable tool for solving the farmer's problems. That service has often paid off in better cooperation in other areas such as enforcement.

Since its beginning, the intercept feeding technique has perhaps being used by the Province of Saskatchewan more than any other agency. They have refined the technique with the development of several innovations including the use of round and loaf bales rather than pelleted rations. Cubed alfalfa has also been used as an alternate feed source, particularly for elk. It is my understanding that Alberta field staff have also used the technique to some extent in recent years.

OTHER USES FOR INTERCEPT FEEDING

There are also other important uses for this technique. Intercept feeding has been used to prevent deer from crossing busy traffic corridors such as the Trans-Canada Highway. In 1982, in Manitoba some 35 deer were killed crossing the Trans-Canada Highway to feed at an elevator at the railroad siding of Kirkella near the Saskatchewan border. The application of bloodmeal along the highway together with some strategically placed intercept feeders solved the problem. A similar application of the technique is currently being used in Birds Hill Provincial Park, east of Winnipeg, to prevent deer from travelling across Highway 59, between the park and the alfalfa-covered banks of the Red River floodway.

The Birds Hill Parks staff have developed an interesting interpretive program around their intercept deer feeding project. In fact, one of the unforeseen benefits of intercept feeding to hold deer and elk in winter habitats is that there are good opportunities

for people to observe and photograph deer or elk in the vicinity of feeding sites. Some wildlife managers view this as an artificial circumstance; but perhaps that circumstance is no more artificial than deer in winter food plots, or in a sunflower field, or even in managed forest habitat that has been opened up by bulldozers, chainsaws or chemical treatment. Innovative approaches could yield major opportunities for interpretive programs designed around intercept feeding.

IMPLICATIONS OF INTERCEPT FEEDING OF DEER AND ELK

There are long-term implications of any program whereby feed is provided out-of-hand for wild ungulates - regardless of the purpose.

For farmers and wildlife management agencies, intercept feeding provides a cost-effective method of preventing deer and/or elk damage to stored hay. Deer and elk-proof fences, and electrified wire barriers are perhaps more foolproof but problem animals often move on to nearby farms with more vulnerable hay stacks.

For wildlife management agencies, intercept feeding also provides a means of maintaining deer and elk on public lands during winter, thereby maximizing the use of lands set aside for wildlife. On the negative side, deer using intercept feeders situated on Wildlife Management Areas or other crown lands provide convenient targets for poachers, and for persons who through special hunting rights may take deer and elk at any time of year on public land. There is also the potential for harassment of deer by snowmobilers and by predators such as coyotes and dogs.

It is recognized that a sound harvest management strategy is an important part of any deer or elk damage prevention program. However, the Manitoba experience is that even with relatively low densities of deer or elk in farmland habitat, serious hay damage can occur.

Hunters see intercept feeding as an apt illustration of how deer can be saved from decimation by winter weather. The public,

too, sees little difference between the intercept feeding of deer or elk to maintain them on crown land, and the wholesale feeding of these animals to help them survive the rigors of a severe winter.

The success of intercept feeding of elk and deer has crystallized the need for wildlife managers to face squarely some hard philosophical, political and benefit/cost questions on the matter of if, when, where and to what extent supplemental feeding of deer and elk should be applied in annual management programs.

It is inevitable that white-tailed deer, here at the northern limit of its range, will experience periodic severe winters that will decimate their numbers regardless of densities. However, wholesale feeding programs are expensive, once damage prevention ceases to be the primary objective. And yet, the reality of contemporary wildlife management in an age of space and computer technology is that it is politically and socially unacceptable for wildlife managers to stand by and allow nature to take its course, particularly if deer numbers are not at some predetermined population goal.

In Manitoba, the current philosophy calls for wildlife managers to use whatever tools they have at hand, including sound harvest management strategies to keep winter losses to a minimum. One of the tools used this last winter was a supplemental deer feeding program applied to a well defined emergency area. The government enlisted both volunteer efforts and the donation of funds from the public to implement the program.

The current view in Manitoba, albeit under review, is that to stand on traditional wildlife management principles which largely discounts the role of supplemental feeding would result in widening the credibility gap between wildlife managers and the public, including their political representatives. It is feared that this could damage support for other ongoing traditional and essential wildlife programs particularly in the area of habitat preservation.

Wildlife managers should make no pretense that all deer can be saved in a harsh winter. Only selected and strategic parts of the herd can benefit from even an all out emergency feeding program. That fact must be made abundantly clear to the public.

It is fair to say that many, particularly professional wildlifers, still view deer and/or elk feeding, for whatever purpose with some skepticism. But to quote veteran Michigan Deer Biologists Louis Verme and John Ozoga, "traditional principles aside, perhaps biologists should stop viewing artificial feeding as professional hearsay and realize that when properly done, it can serve as a valuable tool in the current state of the art". Notwithstanding the best government efforts, deer habitat will continue to decline in Agro-Manitoba. The one hope of maintaining viable deer numbers there is to maintain remnant pieces of thermal cover (bush) wherever possible and provide deer with the best source of food energy available.

SESSION IV

ROLES AND RESPONSIBILITIES OF PUBLIC AND INDUSTRY IN FISH AND WILDLIFE MANAGEMENT

FISH AND WILDLIFE CONSIDERATIONS IN PROJECT DEVELOPMENT

R. WEBB
R. WEBB ENVIRONMENTAL SERVICES LTD.

Industrial projects in Alberta provide a unique opportunity for managing fish or wildlife on a local scale. Specific management techniques have been addressed in previcus workshops and will be mentioned only in passing in this paper. I will instead review the major processes by which industry identifies, plans for and undertakes the management of fish and wildlife within the province.

My paper will be in two parts -- (A) an overview of current processes and (B) some comments and suggestions. Hopefully the latter will provoke you to share your views and ask for clarification of mine.

I have chosen the oil and gas industry as a basis for review because it is publicly prominent with wide-spread interests and activities. It has not been selected because of better or poorer performance than other industries.

SOURCE

My experience has been as a wildlife/environmental/planner/manager working mostly with multi-national oil companies and governments. I have been responsible for a number of environmental assessments (EIA) and development and reclamation plans (D&R) for oil and gas projects.

The comments and suggestions in this paper are my own unless otherwise specified, but I must acknowledge general and in some cases, pointed input from Fish and Wildlife Division staff members and industry representatives who answered a brief, confidential questionnaire.

I found a wide-spread reluctance on the part of both civil servants and the oil and gas industry to publicly air either griev-

ances or good works. Nonetheless, some of each have surfaced and I share them with you, anonymously.

THE ALBERTA SOURCE

TERMS

1. Management

A broad but not all-inclusive interpretation of the term management has been taken within this paper. Table 1 shows it to include both active and passive measures of resource and resource base protection, manipulation or compensation for the express benefit of fish or wildlife. It includes programs of study, planning and administration related to the above. Either the animals or their utilization by man may be the focus of management. Protection of a project from wildlife is also considered a management activity. Not directly considered are those activities designed primarily to meet air and water quality standards or to benefit soils, forests, or other land-based resources.

2. Project Phases

Oil and gas project development takes place in phases, each subsequent phase dependent on the successful completion or near completion of the previous phase. Table 2 illustrates their usual chronological order. Consideration of fish and wildlife management opportunities differs at each phase.

INDUSTRY MOTIVATION

Fish and wildlife management roles and responsibilities assumed by industry in Alberta are generally pursuant to regulations and guidelines established and interpreted by the provincial or federal governments. Yet, there is corporate initiative within and sometimes beyond that framework, often the result of individual effort by environmental professionals. Table 3 illustrates some of the motivating forces at work in the province.

TABLE 1. Fish and Wildlife Management Categories

A. STUDY

- surveys to refine understanding of distribution and habitat dependency
- design studies
- regional surveys as a basis for population management
- population and habitat monitoring

B. SHORT-TERM PROTECTIVE MEASURES

- minimize animal disturbance
- reduce mortality

C. HABITAT MANAGEMENT

- avoidance and protection of habitats
- enhancement or re-establishment of habitats to achieve or surpass previous productivity levels
- purchase of alternate lands

D. NUISANCE ANIMAL CONTROL

- beaver, bears, etc.

E. HARVEST OPPORTUNITY AND CONTROL

- local harvest restrictions
- access provision or control
- trapping area adjustment and/or compensation
- alternate income opportunities for trappers

F. MANAGEMENT PLANNING AND ADMINISTRATION

- project area
- area

TABLE 2. Stages in Project Development

APPLICATION	PRE-APPROVAL
SURVEY AND DESIGN	
SITE PREPARATION	POST-APPROVAL
CONSTRUCTION	
OPERATIONS	
ABANDONMENT	

TABLE 3. Motivating Forces for Oil and Gas Industry Participation in Fish and Wildlife Management

REGULATIONS	GOVERNMENT
DIRECTIVES	
GUIDELINES	
APPROVAL PROCESSES	
CORPORATE POLICY	INTERNAL
INDUSTRY STAFF	
CONSULTANTS	
PUBLIC	EXTERNAL
MEDIA	

1. Review Processes

Government review or referral processes ensure that most oil and gas project applications are scrutinized for potential impacts upon fish or wildlife. Projects with potential for significant impact and/or further concern are subject to formal study and public meetings through major approval systems. Lesser projects receive internal review, generally by referral of applications to a number of agencies.

Table 4 lists some of the review and referral processes used for this purpose in Alberta. Major processes were developed and first applied in the early 1970's. Internal referral systems have been refined and expanded in recent years.

Fish and wildlife resources are recognized within guidelines and directives developed for approval systems. The applicability of specific guidelines to specific projects is determined in a number of ways -- some arbitrary, others negotiable. The application of guidelines to large projects, in particular, is a point at which government policy of the day can be introduced. Approval systems require a flexible approach so that non-issues do not cause unnecessary effort and delays.

Permits issued at several project phases may have attached conditions that stipulate further study, changes in facility location, design, operation or abandonment or other measures of impact prevention, mitigation or compensation. In many instances, those conditions pertain to fish or wildlife resources.

2. Other Sources

Consultants and industry staff can play meaningful roles in determining fish and wildlife activities at all stages of project development. Concepts of management are often identified in pre-approval stages by consultants. Impact management or resource enhancement schemes may be proposed to administrators by industry environmental staff with or without the advice of consultants.

Perhaps more than any other industry factor, increased numbers of fish, wildlife and related professionals on industry staff

TABLE 4. Major Project Review Processes and Permit Referral Systems

ERCB	APPROVAL-IN-PRINCIPLE
EIA	
D & R	
EIS	
SEAC	
CLEAN AIR	AIR AND WATER QUALITY
CLEAN WATER	
WATER USE	LAND/RESOURCE USE
STREAM CROSSING	
PLA; LOC; MSL	
LAND USE	
DEVELOPMENT PERMIT	LOCAL GOVERNMENT

rosters are responsible for improved management initiatives in recent years. Biologists were first hired in the early 1970's, with peak numbers added in the late 1970's and early 1980's. Hirings have been restricted since 1982.

Not all industry staff are equally effective, but companies that act before being asked by governments usually employ good professionals, although progressive managers, enlightened company policy and consulting advice may also be involved.

Many of the larger companies have environmental policies that promote environmental protection. Whether prompted by altruism, shareholders or public relations, they serve as guidance to managers.

The public and the media can both serve to motivate company actions. Most companies with which I have been associated, respond positively to reasoned stands presented in direct fashion. The industry in general spends increasing effort towards effective communication with locally involved citizens, partly in response to government urging.

METHODS

1. Planning for Fish and Wildlife

Project planning for fish and wildlife is predicated mainly upon the corporate need to satisfy company and government policies, applicable acts and regulations and requirements of approval systems according to an application schedule based upon anticipated project phasing (Table 2).

Consultants with government and/or the Alberta Energy Conservation Board (AERCB) is usually an initial step. Scoping studies may be used to identify, schedule and estimate costs for initiatives required by a large project. Literature reviews and local resource evaluations may follow if environmental concerns are not readily identifiable. Issue identification is a process often employed by industry to priorize apparent concerns, especially if major approvals are involved.

Large or otherwise significant projects may require identification and commitment to management concepts through one or more approval processes. After approval-in-principle, detailed initiatives are derived as required. Smaller projects allow rapid movement to detailed design and implementation phases.

In a properly planned project, fish and wildlife input is provided to engineers with respect to facility location, design and operations. Site preparation, abandonment and reclamation procedures also take fish and wildlife into account.

2. Implementation of Initiatives

Detailed initiatives are undertaken in concert with local government staff. Land use and other permits provide opportunities for evaluation of management proposals (or re-evaluation in the case of larger projects).

Some additional investigation may be required at the very local or site level, usually as confirmation of detailed design options.

Implementation procedures are checked in the field and may be adjusted to ensure satisfactory compliance with objectives. Follow-up activities occur until field conditions are stabilized. Subsequent monitoring may or may not occur.

COMMENTS AND SUGGESTED IMPROVEMENTS

Consideration of fish and wildlife by the oil and gas industry over the last 12-14 years has increased from near zero to commonplace. Many respondents confirmed by belief that the co-operative system(s) for ensuring project recognition of environmental concerns in Alberta is working reasonably well for fish and wildlife.

Notwithstanding the above, there can be improvements to the system. As with any complex activity involving many levels of co-operation, periodic re-evaluation and refinement is beneficial. The following list of positive suggestions is offered for consideration. While comprehensive, it should not be deemed all-inclusive.

Approval Systems

1. Project Screening Process

Partly in response to industry pressure for clearer and quicker pathways to project approval, there have been recent attempts to streamline provincial project review processes. A certain amount of streamlining would appear compatible with public sentiment and, of course, a reduction in front-end (pre-approval) costs and delays would be acceptable to the industry. One way of streamlining is to identify for further attention at the assessment level only the most significant environmental concerns, relegating other lesser concerns to the non-issue category. Unless classified as issues, project interactions with the environment would be dropped from terms of reference for full examination. Fish or wildlife management concepts if based on non-issues, would therefore not appear in publicly available review documents (EIA's and D & R's), putting greater onus on civil service vigilance during reviews of lower profile, less comprehensive permits, usually at later project phases. Failure to clearly establish fish and wildlife needs at the conceptual level within public documents could lead to reduced attention at the detailed level. Guidelines for project approval processes are explicit in Alberta. They provide check-lists of environmental parameters that provide a comprehensive basis for review. Streamlining of approval processes should not lead to incomplete public accounting based on partial lists.

Clearly, priorizing of environmental concerns at the overview level is important and necessary, but the temptation to preclude all consideration of what may appear as relatively less significant resource concerns should be viewed with caution. Consultants, industry and government professionals should be alert to this possibility and endeavour to ensure that all resources are adequately represented in initial screening processes.

The potential for local wildlife perturbations is regularly judged on the basis of overall distribution and status of the species restricted in numbers or range within Alberta, are accorded high

value. Yet species that are abundant and widespread receive lower values, or are ignored. That is a sound basis for providing perspective, however, it fails to take into account the incremental effects of a large number of projects over time, which may be significant in a confined region.

2. Inspection and Approval of Design Proposals

Both industry and government perceive a need to simplify and standardize government requirements between companies and regions of the province. Government guidelines describe acceptable stream crossing measures, for example, and referral biologists expect proposals consistent with those guidelines. It concerns some company biologists, however, that non-conforming approaches may not be accepted, even when, in their view, they are equally efficient. Some concern has been expressed about inexperienced and inflexible field staff with little time to inspect and therefore learn of new approaches. Short-handed government staff, conversely, are reluctant to approve precedents because other companies then complain of unfair treatment.

The answer to these concerns appears to lie in better staff training, improved communication and greater availability of time and resources at the regional level. A busy regional habitat biologist processes several hundred referrals a year in addition to other duties, leaving little time for innovation.

3. Compensatory Activities

Compensation in dollars for fish and wildlife losses is not viewed with favour by all industry components, and yet costly restoration of disturbed habitats is undertaken. Compensation in kind for unavoidable fish and wildlife losses require imagination and courage, but should be regularly considered. Courage is necessary since it may draw criticism because of the appearance of inequitable treatment. The risk, however, can be repaid in fish and wildlife management initiatives of greater value and significance to those resources. Let me give you two examples -- one fish, one wildlife:

a) Instead of rehabilitating stream sections of low or moderate value at the point of disturbance, why not improve or create spawning habitat elsewhere on the stream? Assuming that spawning habitat limits populations, greater overall benefits could perhaps accrue for the same expenditure.

b) Instead of local habitat rehabilitation (beyond that required for sustained erosion control) that benefits only species of abundance in areas lightly used by the public, why not commit similar funds to acquiring for provincial management, critical land elsewhere in the province?

4. Development and Reclamation Plan Availability

As a matter of policy, applications for Development and Reclamation approvals are not made public by government without the applicant's approval. Consequently, D & R plans are seldom seen by the public even though they may constitute the primary basis for initial review of project environmental implications. Notable exceptions occur when EIA requirements are waived and D & R documents become important support material at ERCB hearings. Consideration should be given to public availability of all D & R plans.

Project Planning

1. Relating the Regional Plans

Major wildlife and fishery management initiatives by industry would benefit from relating to regional species or land use plans and planning concepts -- mostly non-existent at the moment. Fish and Wildlife Division provincial policy is clearly enunciated and helpful, though local clarification is required. Where industrial activity is intense and its' resource effects potentially significant, more effort is needed to coordinate industry management initiatives with regional government aspirations.

2. Habitat Rehabilitation

Wildlife habitat rehabilitation approaches applied by industry are often based on broad principles rather than local knowledge of species needs. Reclamation based on species requirements would increase effectiveness of programs.

A rational set of species habitat guidelines should be provided by government, augmented by local industry confirmation on a key species basis.

3. Wildlife as an End Land Use

Wildlife production should be identified as the prime "end land use" in some areas of major disturbance. The current practice of emphasizing agriculture in better growing regions, and forestry elsewhere, needs to be modified.

Wildlife end land uses may be justified for certain areas by realistic pre-disturbance wildlife productivity determinations, an activity seldom done well by either industry or government. Currently available wildlife capability ratings are useful but may not adequately represent the values involved.

There is a related need for realistic determinations of wildlife rehabilitation potential to assist in identifying goals for reclamation. To this end, studies of levels of wildlife productivity achieved on older reclaimed lands throughout Alberta would be enlightening.

4. Monitoring

Meaningful follow-up studies by industry are rare. Predictions are made, concepts defined and programs implemented, but monitoring of population responses is seldom undertaken. Syncrude lease wildlife activities are an exception. Monitoring programs can only be expected of industry where significant impacts were predicted and baseline studies accomplished. If cooperatively designed, monitoring can provide information to government that is useful in a regional sense.

A credibility gap remains with respect to oil and gas development impacts upon furbearers and ungulates in northern regions. Seismic and access monitoring studies may be useful, especially if cooperatively designed and implemented.

Project Implementation

1. Supervision and Enforcement

Supervision and enforcement of permit stipulations are generally the responsibilities of land management agencies. The overall performance of industry at the field level is best summed up by one regional comment -- "Guideline and conditions are followed well by some companies, not so well by others, and virtually ignored by a few."

Fish and Wildlife officials want companies to come and talk prior to application, provide longer lead time for inspection and comply more consistently with permit conditions. Companies want government to inspect more quickly and more often, establish conditions consistently throughout the province and see more readily the advantages as well as disadvantages to wildlife of some development.

Broader use of fish and wildlife professionals by industry would result in improvements as would increased support for regional Fish and Wildlife staff.

2. Access Control

Control of public access on roads constructed by industry in wild lands of the foothills and boreal forest is still not totally resolved. Many access roads provide desirable fishing and hunting opportunity -- others, even though gated, present tempting challenges to a few perverse operators of private vehicles.

Permanent solutions must be found to this, a key concern of industry, government and the public.

Other Industry Activities

The oil and gas industry not only "manages" at the project level but contributes in other ways. The following examples serve to illustrate the scope and nature of these activities:

- provide funds and logistical support to University and other research endeavours
- cooperate with wildlife agencies on joint projects
- support educational programs including symposia such as this one
- participate on committees dealing with regulatory and other issues.

Cynics would suggest nothing is done without profit in mind. Nevertheless, there are costs to industry and quite likely benefits to Alberta from these and other activities.

Recognition of Industry Efforts

Extra corporate effort towards fish and wildlife management may never be rewarded by quicker or less expensive approvals, the usual yardsticks applied by corporate managers. It falls on government and the public to recognize such efforts in other ways, not the least of which is at conferences such as this. Perhaps this society could establish an annual award for unsolicited corporate endeavour on behalf of fish and wildlife.

PUBLIC CONSULTATION IN RESOURCE MANAGEMENT PLANNING

PREPARED BY
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CHANGE IN THE BUSINESS ENVIRONMENT

In the last few years there have been significant changes in the business environment in Alberta, Canada and internationally. Social, technical, economic and political forces are all affecting the work we do (Figure 1).

All these changes, both positive and negative, are causing people in each and every profession, both in government and out of government, extreme difficulty.

It is likely that all these factors will continue to change possibly with ever increasing speed. The 1980's will continue to be the focus for change, challenge, confusion and concern. In many instances we find ourselves at a crossroads. The major issue we will have to cope with will be our ability to manage change (Figure 2).

One of the major concerns which is disrupting many of our so-called "professions" is that people are desiring, in fact, demanding to be involved in the decisions affecting them today. The elitist attitude of the professions has been thrown into question. All our assumptions are being questioned and the various publics want to know how we plan and often want direct participation in this process. What used to be a neat, relatively straight-forward process has been torn asunder.

One of the best examples of this can be seen in the Northwest Territories today. I am currently working on several projects

Figure 1. Change in the Business Environment.

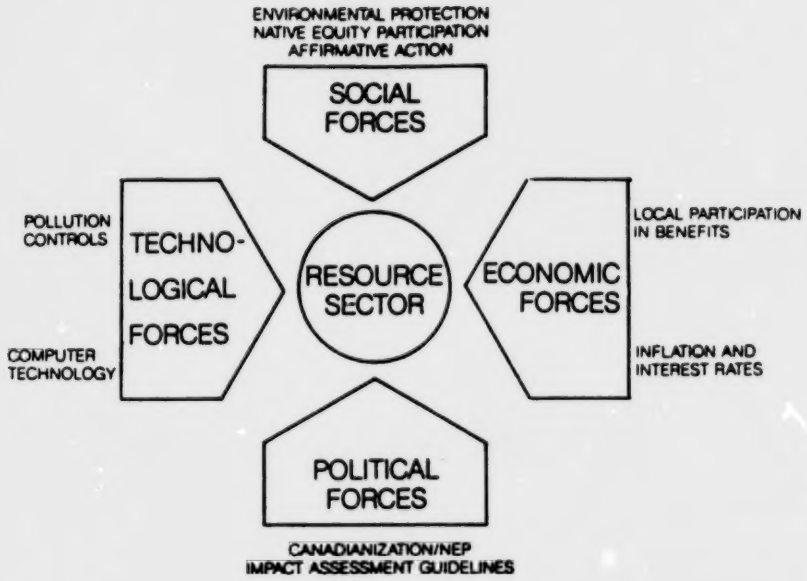


Figure 2. Key Factors of the 1980's.

KEY FACTORS OF THE 1980's

CHANGE
CHALLENGE
CONFUSION
CONCERN
AT A CROSSROADS

Major issue of the 1980's will be our ability to manage change. Will we be able to make decisions in an environment of political and social uncertainty?

related to the Beaufort/Mackenzie resource development projects. The previously noted increased level of the need for citizen involvement and consultations is at its peak in the Territories.

The N.W.T. is engaged in a process of short and long-term change of their political process and systems including:

- constitutional change;
- devolution of power;
- provincial status;
- east/west territorial separation;
- land claims;
- regional governments; and
- Development Impact Zones (DIZ) groups.

With all these ongoing activities, no one can yet determine the outcome. The only sure fact is that everyone wants to be involved and consulted on everything. This is having incredible consequences on how impact assessment and resource development is being carried out, and, or course, the requirements necessary to get a project through the regulatory process and implemented.

Caught up in this process is the potential for Beaufort/ Mackenzie development.

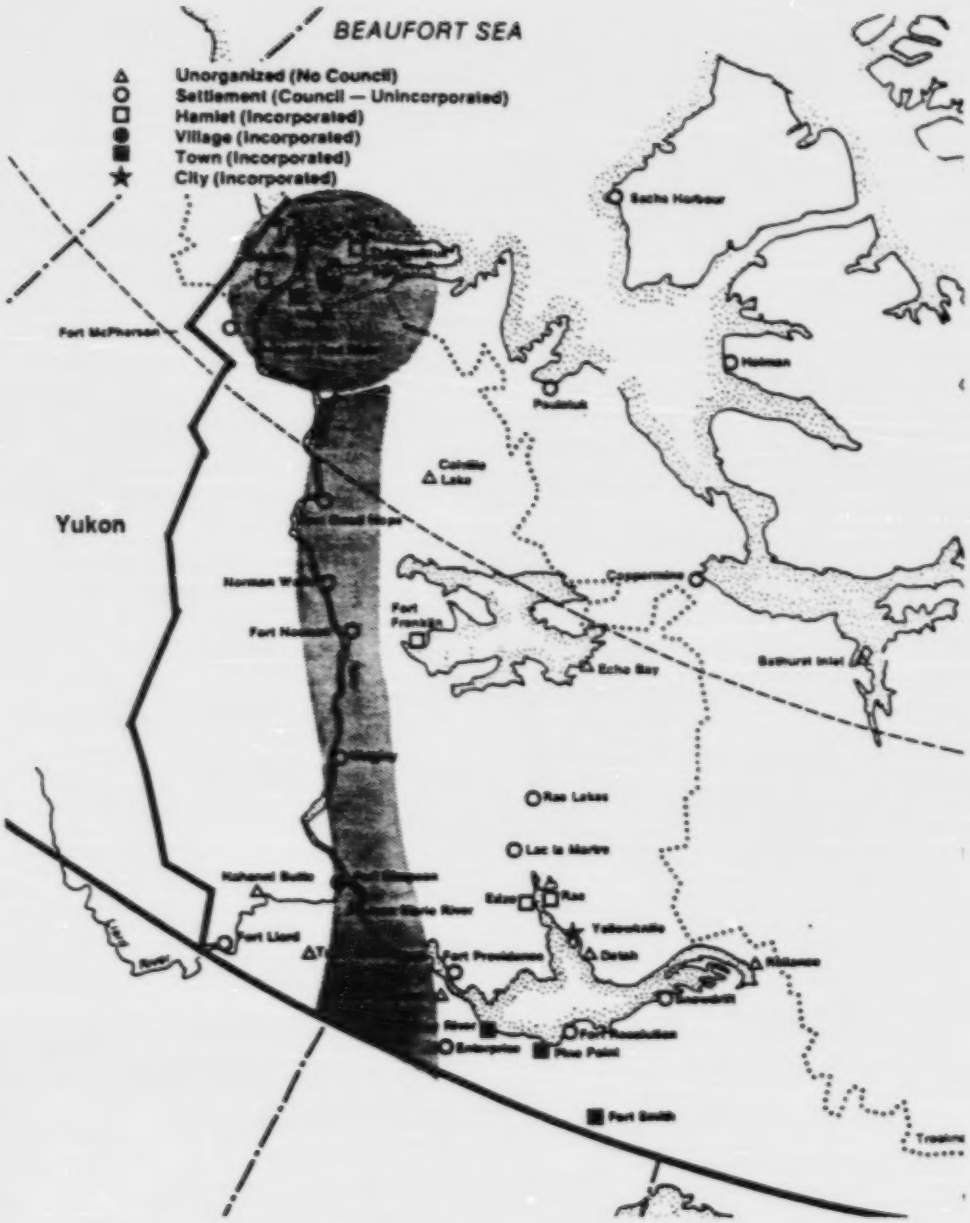
Who's ever project(s) goes-ahead, assuming go-ahead occurs at all, and a pipeline is required; an interesting phenomena may occur. Precedence is being established for individual community agreements (Figure 3):

- BP at Fort Good Hope;
- Petro-Canada at Kitimat; and
- Dome at Port Simpson.

The result of this is that to build a pipeline in the Territories, the following agreements may have to be developed:

- Comprehensive Agreements
  - Federal Government
  - Territorial Government
- Socio-Economic/Land Use Agreements
  - Dene Nation/Metis
  - COPE

Figure 3. Communities in the Beaufort/Mackenzie resource development area.



- Community Agreements
- 20 Communities

To manage in such an overwhelming situation ,there will need to be a PRO-ACTIVE stance taken by the companies and others involved. It will be essential to work with all these organizations to determine what will be required in the agreements and see if there are ways to work out mutually acceptable agreements. If the companies and government agencies don't get out there, then the likelihood is that positions will be entrenched and everyone will have to live with the results (Figure 4).

On any project, including the Beaufort/Mackenzie, it is essential to make contact with the local communities, governments and other local and regional organizations.

If you don't you may face serious delays, changes to the project or outright cancellation. The best example of this was a comparative study completed by Petro-Canada. The study showed the losses on a range of projects which had been delayed, cancelled or substantially modified due to environmental, social and/or political reasons (Table 1).

WHAT IS PUBLIC CONSULTATION?

So, based on the previous discussion, there is a need to understand public consultation. When should you use it? Why? And most importantly what techniques should be utilized?

First of all, public consultation is a PROCESS. It is a process to both INFORM and INVOLVE people, groups, organizations, agencies and governments.

You, as a planner or "impact assessor" need two things,

- information; and
- support

to do your job. These are critical if you are to succeed. To achieve this end you must involve many so called "publics" whether citizens or government agencies.

Figure 4. Socio Economic Planning.

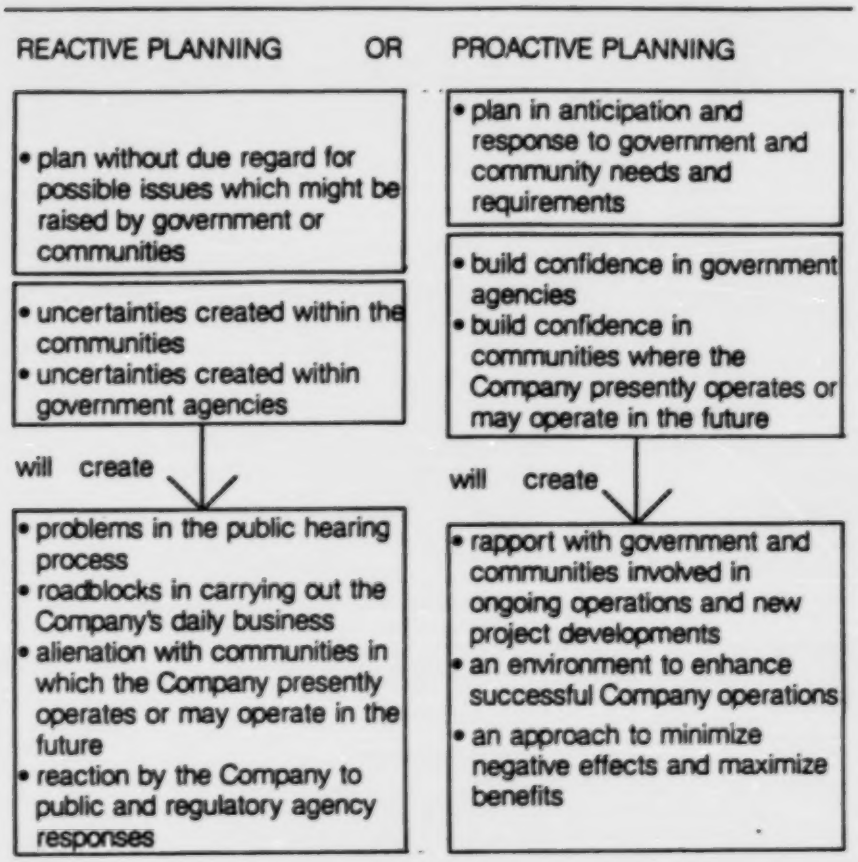

REACTIVE PLANNING
OR
PROACTIVE PLANNING
• plan without due regard for possible issues which might be raised by government or communities
• plan in anticipation and response to government and community needs and requirements
• uncertainties created within the communities
• uncertainties created within government agencies
• build confidence in government agencies
• build confidence in communities where the Company presently operates or may operate in the future
will create
will create
• problems in the public hearing process
• roadblocks in carrying out the Company's daily business
• alienation with communities in which the Company presently operates or may operate in the future
• reaction by the Company to public and regulatory agency responses
• rapport with government and communities involved in ongoing operations and new project developments
• an environment to enhance successful Company operations
• an approach to minimize negative effects and maximize benefits

Table 1. Capital Lost on Projects Cancelled or Delayed Due to Social, Environmental or Political Reasons.

Project	Lost Capital	Total Project Capital Costs	Percent of Lost Capital to Total Project Capital Costs
Trans-Alaska Pipeline	$800 million	$10.6 billion	8 percent
Garrison Diversion Unit	$400 million	$632 million	63 percent
Staten Island LNG Terminal	$35 million	$35 million	100 percent
Pt. Conception LNG Terminal	$150-180 million	$932 million	16-17 percent
Dodds/Roundhill Coal Mine	$5 million	$200 million	2.5 percent
Birch Island Uranium Mine	$1.5-3 million	$20 million	8-15 percent
Bathurst Peninsula Exploration Program	$15 million	$15 million	100 percent

*Based on Study Completed by Petro-Canada (1978)

Public involvement can achieve some very positive results; it does not and should not be viewed as a negative or burdensome "attachment" to the process.

As an example, in the first phase of the Slave River Hydro-Electric Project, there were some serious problems in crossing the Peace-Athabasca Delta. The engineers and route location team were up against a wall for many reasons:

- Environmental Sensitivities in any crossing of the Delta;
- Long distances to cross Lake Athabasca; and
- Implications of access roads on resource harvesting to name but a few.

A public consultation process had been established to involve the public in the entire process. At one of the project meetings, attended by community representatives, this issue was raised. One of the "solutions" being put forward involved an underwater 500 KV transmission line. Because the only plant which could built this underwater cable is located in Europe, the costs of building, transporting and constructing the line could have been in the hundreds of millions of dollars.

As the community representatives listened to this, they suggested a follow-up meeting at which they identified a series of small islands across the mouth of Lake Athabasca. These, coupled with several artificial islands, could be built, across which the 500 KV line could be located with very little environmental damage and at low costs compared with all other options. No one else had recognized this "opportunity". Will the community ever get recognition for this? It is unlikely, but it is an example of how involving communities can achieve unexpected benefits both in time as well as in financial savings.

PUBLIC CONSULTATION VERSUS PUBLIC PARTICIPATION

I would like to make it clear that I have a bias in this activity called "Public Consultation". Many people use the words involvement, participation or education all interchangeably. This is

not the case. Very few public, let alone private organizations, truly want public participation in decision-making. They want to inform, to educate and at best to involve people in the process; they don't want them participating directly in the decision-making process. One of the few situations where I have seen at least some true public participation is in the Integrated Resource Management Planning Process of the Alberta Government. While there are many views of the successes and failures of this particular public involvement process, I have watched some of the participation activities achieve success.

Because of the "sensitivities" surrounding the Revised East Slopes Policy, coupled with the timing of the public meetings (hearings) in the Castle Planning region, near Pincher Creek in the Southwest corner of the province, I was asked to chair meetings in Lethbridge, Pincher Creek and Blairmore last December. The Resource Evaluation and Planning Branch wanted an independent chairperson in an attempt to defuse some of the public concern. Besides the official meetings, I sat in on one meeting between the Branch, some senior civil servants and the ranching community in and around Pincher Creek. The issue was the potential transfer of some sections of land from the white zone into the green zone. The reasons given by the government for this transfer were the desire to better manage the land under the auspices of Forestry, who manage all green area lands; the second reason was so the lands could not be sold in the future.

The ranchers were nervous of any change. They were afraid they would lose their lands. After a long and heated debate, an interesting solution was found. The government would agree to leave the lands in the white zone as long as the ranchers would agree to have a clause written into their leases or deeds that the land could never be sold. This was agreed to and both sides came out with a win/win situation. Again, this shows where citizens can be involved in decision making and an otherwise sensitive situation defused with all sides feeling like they had achieved their goals.

TRENDS AND ISSUES

It is critical to recognize that many new trends are occuring in impact assessment today. Recently, I completed a study under the Environmental Studies Revolving Fund (ESRF), Issues North, which reviewed methodologies of impact assessment from Berger until the present time in an attempt to determine what methods had worked and determine in what directions impact assessment was moving. Three trends are of note to this group:

- Issue Focused Impact Assessment

  The emphasis in the past has been on data collection; data for data's sake. The shotgun approach is no longer working; it is necessary to focus on the key questions in the communities or within the region: As we move through the eighties, people are more aware of the social and cultural effects of resource development and they are insisting on early participation in the decisions (scoping). ... In addition, the mitigation phase of the EIS process is receiving greater attention. Officials not only want to know what the impacts might be, but also what management options could be developed. In short, the EIS process is moving away from being a declaratory document which merely discloses impacts, to becoming a management tool which citizens, industry and government can use to reach decisions about the future. This, of course, has significant implications on how the public is involved and consulted in any impact assessment.

- Impact Management

  Change is so drastic that it is impossible to accurately predict, let alone assess, effects of change on communities. "At best we can only forecast in terms of ORDERS OF MAGNITUDE. In fact, this is what we have learned to live with. Any more detailed forecasts will tend to be wrong due to some intervening variables whether political, economic or project-related." Therefore, we must

develop methods to manage impacts whether change is large- or small-scale. Very few projects have utilized, let alone documented, an impact management process. Several of note are:

- Rock Springs Growth Management Study - U.S.A.;
- Tumbler Ridge New Town, Northwest B.C.; and
- Arctic Pilot Project, Petro-Canada.

Impact management requires that decision-making authority be "on the ground" at the development site not isolated in the head office of government or industry.

It is becoming essential to build community capacity to cope with rapid change, whether growth or decline. Impact Management Strategies have to be developed to work at the local and regional levels. They cannot be implemented from afar; they just won't work. Again, this has implications for public consultation. The local and regional residents, local corporate personnel and local government officials have to be much more extensively involved if impact management is to occur and be a useful, and useable strategy in the environmental and socio-economic impact process. These trends indicate that, after a decade, the Environmental Impact Assessment process is maturing. It is going to become much more pragmatic, useful and useable. But this maturing process is going to mean change for all of us practicing in the field. Some will adapt; others will not. These trends are happening today. As an example, the Government of the Northwest Territories (GNWT) has recently commissioned Praxis to undertake a study of Growth Management Strategies for the Beaufort/Mackenzie. In effect, we are looking at a "Dictionary of Impact or Growth Management Strategies"; strategies which have been utilized in the NWT, Canada, Alaska, the North Sea, Australia and New Zealand and the Continental United States. The Diction-

ary utilizes the following framework to organize the strategies:

S 1. Local/Regional Economic Diversification
S 2. Local/Regional Employment
S 3. Community Based Economic Development
S 4. Local/Regional Business Development
S 5. Community/Regional Adjustment
S 6. Community Services
S 7. Administrative/Organizational
S 8. Housing/Accommodation
S 9. Planning/Infrastructure
S10. Financial/Taxation
S11. Information Exchange
S12. Compensation and Monitoring

In effect, what we have is a mitigation strategies dictionary. This will be an "IDEAS" manual that people can use to identify and develop more useful and appropriate strategies for mitigating impacts and managing project effects.

SUMMARY

In summary I would like to leave you with several points to build into any public involvement or impact assessment process you may undertake in the future:

- The times are changing; impact management and issue focussed assessment will mean local/regional involvement to a much more substantial degree;
- Involve the public in your planning or assessments, they are not going to go away;
- Public consultation is a continuing process. It is not one meeting with no other involvement. This has not worked and will not work in the future.
- Public consultation is not public meetings. There are many techniques and strategies which can be utilized;

- Remember to involve your own people. It is very embarrassing to find your own departmental or industry people working at odds to you in the field;

And finally:

- Don't be afraid of public consultation. Get out there and do it, but before you do it, make sure you know what you're doing.

Remember ... there are a lot unknowns out there ... be prepared and be flexible.

THE ROLE OF CANADIAN HUNTER EXPLORATION IN THE ALBERTA DEEP BASIN

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I. INTRODUCTION

There is a saying that "Nature is able to operate without the benefit of man and soon accommodates to both mans' ignorance and his folly". Nature will operate much better if man performs with respect and wisdom.

We, at CanHunter appreciate the dedication of the Crown and its regulatory bodies to ensure that Nature's rehabilitory efforts are minimized while orchestrating the provincial, social, economic and environmental goals.

Canadian Hunter as a "corporate citizen" of this province was particularly pleased and honored when recognized with a Bighorn Award in 1984. The citation read "For concerned and conscientious effort in gearing exploration and production efforts in the vast Alberta Deep Basin towards minimization of impact on the environment". Our sincere belief is that such efforts are simply "a part of the job" we do in our resource industry.

In late 1976, Canadian Hunter Exploration hit it big with exploration efforts southwest of Grande Prairie. The fortunes of the 100% Canadian company were soon to change. Development of the Deep Basin was to also make a significant contribution to the economic well-being of Alberta and Canada. Despite common belief of natural gas shortfall in "conventional" Alberta and the enticement of industry to frontier areas, an idea and perseverance awakened a sleeping hydrocarbon resource giant which is now known as the Alberta Deep Basin. The boundary of this immense sedimentary basin is roughly 300 miles long by 50 miles wide. Hydrocarbon bearing sediments extend to

a depth of 20,000 feet. Established natural gas reserves are currently 13 trillion cubic feet. Hundreds of millions of barrels of natural gas liquids and crude oil are also recoverable. It is Canada's largest hydrocarbon reserve next to the Tar Sands. On a peak day, later this year, the Alberta portion of the Deep Basin will be capable of delivering one seventh of Canada's total gas production plus better than 50,000 barrels per day of crude oil and natural gas liquids.

Canadian Hunter's and industry's efforts have centered to-date on the Alberta portion of the Deep Basin. The area outlined contains about 115 townships. We recognized early in exploration and development of this bonanza that we faced not only the challenge of risk associated with exploitation but also the obligation to explore and develop these lands in an orderly fashion. The nature and existing land use of this area was varied. The topography ranged from scrub spruce, poplar, birch and muskeg through to cultivated farmland; however, the majority was forested, uninhabited, wildlife habitat - some of the finest in the province. An early step in our "game plan" was to completely rephotograph the area and develop an air photo mosaic. This mosaic has been invaluable.

This symposium focuses on fish and wildlife management practices and future strategies. The role of industry as exemplified by Canadian Hunter's experience in the Deep Basin is perhaps best illustrated by briefly relating our efforts and requirements in several facets of the business. Each of these facets could well be stand-alone papers. Of necessity I will be brief, providing only the flavor and hopefully an indication of the complexity and required dedication that industry faces on these matters.

Throughout the experiences related below we should remember that:

1. It was necessary for CanHunter and partners to maintain the proper attitude, namely "Co-operation" and not "CONFRONTATION" with regulatory authorities;
2. It was necessary that we be jointed by our partners in these ventures - Texaco, Sulpetro, Esso, Amoco, Domtar,

Bluesky, Prodeco - to name a few, for their financial support;

3. It was requisite that philosophically we perceived and accepted our environmental duties as a part of the total job in developing the resource and to that end we must be sincere in all responsibilities and applications;
4. It was desirable and encouraged that whenever we pursued an environmental activity that common sense and personal ingenuity prevailed and that the activity although complying with regulations, most often went beyond;
5. It was essential to keep authorities informed, to the best of our ability, of future activities; and
6. It was essential to get the authorities involved early in a project since they have good ideas too and can bring experience from many areas.

II. GENERAL OPERATIONS FUNCTIONS - DRILLING AND PRODUCTION

CanHunter alone has drilled more than 200 wells in the Alberta Deep Basin area since 1976. We have constructed four gas processing facilities and in excess of 100 lease facility installation. We have installed nearly 400 miles of pipeline. The future could see these quantities multiplied several times. These facilities have been costly but in line with estimates. Of more importance, all of the facilities have been completed on schedule despite elements and because of the excellent working relationships with authorities and their expeditious handling of approvals.

Some examples of our performance/requirements in obtaining regulatory approvals are listed below. I have omitted reference to all of the basic paperwork obligations.

1. Pre-inspection of overall project early in planning stage be it drilling location, road, construction site, etc.; by helicopter and by road.

2. On site meetings after the pin is set but prior to formal survey.
3. Removal of drilling fluid to remote site - where sub-surface aquifers might be contaminated.
4. Treatment of sump fluids to meet disposal standards.
5. Seed and fertilize all disturbed areas.
6. Install steel portable bridges with pilings, over fish streams instead of culverts or other diversions.
7. Install garbage incinerators at all camps, drill rigs and service rigs.
8. Performed fish studies on streams.
9. Adhered to policy of "Line of Sight" during surveying and lay-out roads. Costly but dog-leg provisions do provide security for game crossing.
10. Wapiti Wildlife Study - referenced below.
11. Reporting cooperation - have endeavored to report infractions to enforcement division of Fish and Wildlife.
12. Developed dug-outs for Fish and Wildlife Associations to raise fingerlings.
13. Borrow-pit enhancement - habitat development.
14. Maintain communication - informally keep all authorities appraised of our near term development plans - limit the number of surprises.
15. Maintain liaison with authorities on safety and environmental precautionary procedures and invite regular inspection.
16. Participation in the Area "T" Oil Spill Co-operative which includes the Deep Basin Area.

The above is but a sampling of our "regulatory" and "beyond regulatory" activity in routine exploration and production operations. Collectively, conducted in the proper spirit, these activities save CanHunter as operator, time and money, save the authorities time in the conduct of their business and unnecessary delays in providing approvals and provide our neighbors - the residents and

wildlife - with a beneficial environment despite our intrusion in the quest for resource production.

In summary the commitment and/or obligation is not without cost. Incremental expenditures such as $65/acre for reseeding, $1,500/mile of road for "dog-legging", approximately $1,500/month for incinerators, $1.3 million in steel portable bridges, $450/drilling day for remote sump fluids and many hundreds of thousands of dollars for helicopter time, to name a few; are incurred. However, the satisfying result is a job to-date that we believe has been done properly and in the public interest.

III. DEEP BASIN PIPELINE CONSTRUCTION

Constructing a pipeline in Alberta generally follows a well defined path of government and other approvals. Basic to the process is receipt of the ERCB permit which is received after land, technical and environmental approvals. There are two types of pipelines - regulated and non-regulated. Regulated pipelines are 6" in diameter or larger and longer than 10 miles.

If a pipeline is non-regulated the ERCB internally issues the permit based on (1) Technical Merit (CSA code and standards), (2) Routing, (3) Land Acquisition, and (4) Stream crossings. Normally this process takes three to six weeks.

If a pipeline is the regulated category a large number of approvals are required before the ERCB can issue a Permit. A Development and Reclamation Application (D & R) must be submitted additionally to Alberta Environment. This application must include (1) Technical Review including routing, sizing, code adherence, alternate routes, stream crossings, (2) complete analysis of environment including topography, soils, vegetation, meteorology, wildlife, residents and historical resources, and (3) an environmental protection plan to minimize or avoid environmental impact.

The D & R application is reviewed by Fish and Wildlife, Water Resources, Forestry, Alberta Culture, Parks and Recreation and Public Lands governmental agencies. Any deficiencies arising in the

application can be raised by these groups through the Department of the Environment. A D & R approval can take up to 16 weeks.

Most frequently a number of "outside" approvals are also required prior to pipeline construction. These include (a) Road Crossing - County or Alberta Transportation approval, (b) Powerline and Telephone Crossings, (c) Pipeline Crossing, (d) Forestry companies with prior timber rights (e) Alberta Culture - non-regulated projects.

Over the past seven years CanHunter has constructed nearly 400 miles of pipeline in N.W. Alberta. On the average, interaction with the many regulatory agencies has resulted in expedient approval of pipeline applications both regulated and non-regulated. We attribute this response to (1) efforts at cooperation, and (b) environmental research and study - both voluntary and required.

We believe it is significant in the successful timely completion of our many projects that the general philosophy of the Projects Group includes the following routine practices:

- Maintenance of a cooperative, non-belligerent attitude towards regulatory agencies and land-owners.
- Initiation and maintenance of effective lines of communication with regulatory staff in Calgary, Edmonton, and field offices.
- Adoption of policy of preliminary meetings and field visits during planning and conceptual stages to address environmental concerns.
- Adoption of a practice of flying all proposed rights-of-way with local Forestry and Fish and Wildlife staff to review important topographical aspects.
- Provision of additional or more detailed information to regulatory agencies without objection at any time during the approval process.
- Maintenance of close liaison with local regulatory representatives during the construction phase.
- Maintenance of Voluntary Programs of Environmental Research/Study. (e.g., Wapiti Wildlife Study, Aerial

Mosaic, Wapiti Streams and Fish Study [Pre-Application and Post-Construction], Archaelogical Assessment and Detailed Soils Report).

In closing this section of the talk let me suggest that the combination of our working relationship with all government agencies (who are just doing their job in the public interest) and our willingness to conduct detailed environmental studies, for the most part voluntarily, has been the key to our successful completion of our work.

IV. SOUTH WAPITI WILDLIFE STUDY

In 1979, three years after discovery of Deep Basin gas and only month before the first gas flowed to sales from Elmworth and Wapiti, corporate philosophical motivation was at work again. This time thoughts were developing which would compliment our hydrocarbon exploitation game plan, provide baseline data on the major fauna of this undeveloped Deep Basin area and provide CanHunter with a better understanding of the total environment or habitat that we would be occupying for some time to come. We knew the study would commence early. We appreciate it would be costly. We knew it would have value in our future operations. And, we believed it was something we would be interested in doing.

The general philosophy? Well, at the time there was no denying the practical, applied operational advantages of initiating and conducting a wildlife study program. But, that being a given, the philosophical approach was to demonstrate a commitment to wise corporate stewardship of the wildlife resource and the land and by making a concerted effort to mitigate the impact of our activities and demonstrate what we considered to be the effectiveness of this approach.

To this end CanHunter commissioned a study to intensively monitor the status of the moose and grizzly bear populations which

included as spin-off, an evaluation of their existing habitat. We were pleased and most fortunate to retain Dr. Brian Horejsi and his staff at Western Wildlife Environments Consulting Ltd. for this project.

The moose study area covered 300 square miles (730 square km) within townships 64 to 67, ranges 8 to 11 W6M, the northeast corner of the area being about 20 air miles southwest of Grande Prairie.

The grizzly bear study area was larger covering about 800 square miles, including most of townships 63 to 68 and ranges 7 to 12.

The moose study began in November 1979 and terminated in December 1983.

The grizzly bear study began in July 1980 and essentially terminated in December 1983, although we conducted a two-month trapping/marking session in fall 1984 and are about to conduct a further three month session this spring.

Chronologically the study proceeded as follows:

1. November 1979, began moose monitoring study, including three complete aerial surveys each winter, snow surveys, track surveys along roads and seismic lines, and browse surveys (how intensively were the willows used adjacent to new leases as compared to similar areas some distance from the lease).
2. In conjunction with 1., the proposed lease locations and access road locations were reviewed in light of possible wildlife conflicts. Western Wildlife acted as an advisor to Canadian Hunter and Fish and Wildlife with respect to conditions applied to LOC and MSL approvals.
3. Mitigation measures were voluntarily applied by Can-Hunter with respect to access and noise and visual impact (i.e., access roads were designed to limit line or sight, intersecting seismic lines were ditched and barricaded, berms were built around leases, and some

drilling dates were adjusted). Of particular value from a wildlife impact point of view was the realignment of road systems.

4. July 1980 - Grizzly bear study began. Twenty-eight individual grizzly bears captured, activity monitored, movements followed, dens located and habitat described, food habits studied.
5. December 1981 - Pre-pipeline fisheries study to determine the status of the fishery in Pinto and Muddy creeks, two drainages to be crossed by the South Wapiti gathering system. Included description of stream characteristics and invertebrate productivity.
6. January/February 1982 - Monitor pipeline activities and liaise with the contractor regarding mitigation measures, during construction of South Wapiti gathering system.
7. December 1981 - Using data collected during the moose, grizzly bear, and fisheries studies, prepared a pipeline development and reclamation application for the South Wapiti gas gathering system. This report still stands as one of a very few whose foundation is original data generated by the applicant (as opposed to regional overviews).
8. March 1982 - Expand moose monitoring project to include the capture of 25 adult female moose, all equipped with radio transmitters and then released. These animals provided a vast amount of exact data on how the moose population was doing with the industrial activities it was exposed to. Included were movements, seasonal ranges, reproductive success, survival and food habits. These marked animals also provided a foolproof check on the accuracy of aerial surveys.
9. March 1982 - Post-pipeline fisheries study to determine whether the construction of the South Wapiti gas gathering system had had an impact on the fish or the

water of the Pinto and Muddy Creek systems.

10. Data on the moose and grizzly bear populations was collected through to December 1983.

PIPELINE MITIGATION MEASURES applied during the construction of the South Wapiti gas gathering system.

a) limit vehicular access to pipeline right-of-way
b) bore some crossings, as opposed to trench
c) guarantee flow of water below trenched crossings
d) limit duration of open trenches in streams
e) lay extra pipe in crossings to avoid repeated disturbances
f) after reclamation, limiting access to the right-of-way by scattering debris from cleared vegetation over an area extending at least 300 m down the line from leases or road crossings
g) providing field supervision of the environmental protection plan by qualified personnel

The objectives of all this effort are two-fold (three-fold if one considers the obvious operational advantages):

1. to maintain wildlife populations at a viable level such that, although they may be depressed in number, there are enough individuals left that the population can recover given the opportunity; and
2. to maintain the integrity of wildlife habitat, both physically and security wise, so that it can support a population that may, in the future, be free of the demands of resource development. (There are two components to wildlife habitat; physical = food; security = cover sufficient to permit the animal to feel safe, thus there may be considerable numbers of trees but the roads on either side cause the animal to be uneasy and it will not utilize that particular island of land).

Work on the South Wapiti Wildlife Study is phasing down at this time. Dr. Brian Horejsi and his associates did an excellent job and now are completing their final reports, concluding reporting which was performed on an interim basis. We are the wiser for these efforts. The mitigation measures we have voluntarily added to our standard procedures do work. We also trust that this initial work may be passed on as a legacy to our government authorities.

V. CONCLUSION

We do not advocate the CanHunter's general philosophy and strategies revealed in this paper be adopted as general practice for industry in Alberta. Nor do we suggest that every resource development project requires the same study intensity. We believe that aside from basic regulations governing the industry activities, each project or development must be viewed on its own with specific regard to size, nature of the topography, nature and scope of the resource operation, the requirements of inhabitants be they man or wildlife and the operator's conscience.

The "bottom line" on timely, profitable completion of resource projects must be the team approach with well defined objectives. The objectives must include perception of potential impediments and obligations. This can best be achieved by professional, cooperative rapport with all agencies and landowners. We recognize this is a "two-way" street between industry and government - but it can be achieved. The results speak for themselves!

SYMPOSIUM SUMMARY AND IMPRESSIONS

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"PRODUCE AND PROVIDE A GOOD ENVIRONMENT
PRODUCE BUT DO NOT POSSESS."
LAO-TZU

Management of Fish and Wildlife in North America is changing rapidly. More demands by users, more resource and industrial development, reduced budgets and changing social values are some of the pressures causing a rapid change in management strategies. Your theme for this Symposium is yet another example of these pressures which call for a critical look at today's programs in preparation for tomorrow. While the theme was similar to other conferences, the make-up of the attendance was significantly different. There were some public representatives of general issues, some agency and university staff but the most distinct group were biological consultants who brought some interesting biases.

Before attempting to report on the Symposium, a few social notes appear useful. I was impressed by the organizational support and membership strength shown by the executive and members of the A.S.P.B. The inter-personal climate was friendly and invited mild controversy. There was a feeling of an "old boys club", but every effort was taken to accommodate invited guests. This was much appreciated.

Summarizing a Symposium such as this is a stimulating experience. But it has its problems. After two days of constant listening, my personal biases were beginning to overpower objective analysis. Therefore rather than try for impartiality, I intend to present my responses as stimulated by the proceedings. In so doing, I take responsibility for any errors, omissions or improper

deductions while the "better ideas" can be attributed to the participants.

The keynote address was given by Robert C. Fields, Manager, Klamath Basin National Refuge, Tulelake, California. He quickly aligned with the conference theme by stressing the key problem is how to react in a corrective manner to changing needs and new opportunities to manage wildlife. And to do so constrained by budgets, changing social values and legislation that always appears slightly out of date. He offered some clues:

1. Employ well-trained and experienced people who are committed to the resource.
2. Don't spend time and money re-inventing the wheel.
3 Do spend time to obtain public support.
4. Wildlife managers need to be flexible to develop and implement programs to maintain the resource.

Program Managers to be flexible (adaptive?) should apply two criteria: first, the needs of the resource have the highest priority and second, public support is necessary but is based on changing social values. These criteria are often in conflict which must be rationalized. Mr. Fields stated that National surveys in the U.S.A. indicate only a small percent of the public had any real understanding of a number of serious issues in wildlife management. But the majority were aware of issues which had received widespread media coverage such as the seal hunt and human-caused injury to animals. The problem here is that the media influences public opinion through exploiting conflict situations. This is especially true when "cute" young of higher mammals are involved. Mr. Fields suggests biologists should make better use of media. I agree, but the fact is that by the time the average field-level biologist is aware of a negative public image, the subject has become politically sensitive and freedom for agency staff (or consultants) to openly discuss the situation rapidly becomes restricted. In face of this scenario the question "Who managers wildlife?" becomes the real issue.

The keynote speaker directed his thoughts within the theme, identified strategies for the future and emphasized awareness of public perception in developing management programs.

Dennis Surrendi, Assistant Deputy Minister of the Fish & Wildlife Division also developed thoughts consistent with the Symposium theme. He reviewed their goals and objectives which have been legitimized by the Alberta Government. His agency places substantial credence in having these approved and in place to quide management. I agree that they provide a guide for action, but I am aware that many jurisdictions have similar statements and still have serious problems. Perhaps such problems are beyond wildlife resource management and enter the broader field of inter-resource management. Nevertheless, approved goals and objectives are a strong step forward and at the very least are necessary for evaluation of current programs.

Mr. Surrendi listed eight policy requirements for implementation of goals and objectives. Three are concerned with research and technical factors, two involve education and professionalism and two emphasize involvement of non-government objectives. Many of these policy needs are similar to those expressed by the keynote speaker.

Mr. Surrendi also dealt with a few specific factors, namely regulations and inventory standards. I agree with his strategic overview but not with his venture into the specifics of management. His desire for less complex regulations is welcomed by all and I acknowledge that some of today's regulations are more detailed than the facts warrant. But as appropriate stock data are obtained for specific populations, I believe the regulations will become more complex. It follows that thoughtful and dedicated sportsmen will have the responsibility to become knowledgable not only about the specific regulations, but about the natural history of the wildlife they seek.

An opening session needs perspective to relate current practice with the past and to help predict the future. Paul Paetkau

did just that. While the first two speakers were concerned with changes now underway, Dr. Paetkau gently and chidingly, reminded us that the history of wildlife management in North America is one of constant change. He pointed out that the horse was a significant technical advance to the native people. It changed their way of life; and technology continues to change ours.

Previous speakers stressed the value of legislation upon which to base management, and Dr. Paetkau brought out an important insight about legislation. It mirrors the values and problems of the day. For example, initial game laws were passed in the late 1800's and early 1900's and reflect the need to protect an agrarian way of life--thus predator control was annoited. I wonder what will be said in 2020 about the goals and objectives of 1985? Did they help or hinder management agencies adjust to changing public values?

Dr. Paetkau introduced reality by listing economic expenditures related to the public's use of the fish and wildlife resources. Fishermen, hunters, viewers and other kinds of users spend about 1/2 billion dollars annually. The worth of the resources is by economic logic something in excess of this amount. But the annual budget is only $26 million. Even allowing for significant input by the private sector, I doubt this amount can manage the resources to the degree implied by the province's goals and objectives. This paradox may well serve as a topic at a later symposium.

Dr. Paetkau's future vision for wildlife involved six trends. One emphasized rare and endangered species and their habitats, four are concerned with human use through specialized approaches, more control and competition for space, while the last describes the changes in the biologist's role from a decision-making manager to technical advisor. This is worth noting for future review.

The opening morning speakers ably presented their views on wildlife management within the theme. How successful were they in describing tomorrow's management agenda? They were successful in

identifying several common trends based on their differing experience. While one might have expected Bob Fields and Dennis Surrendi to hold differing views on how to management wildlife in decades ahead, I found their thoughts very similar. The following common elements were identified:

1. Rapid change is a constant in wildlife management and can be in the technical, economic, cultural or legislative fields.
2. Public confidence is required and is based on mixing technical and social factors to meet high profile problems and opportunities.
3. Successful wildlife programs to benefit increasing numbers of users in new and complex ways will have to reckon with changing social values and competition for habitat.
4. The role of agency biologists is changing from manager to technical advisor.

Let's now turn to the following sessions to see if they agree or have different opinions.

The afternoon panel under Chairman Allan Birdsall provided rather courteous perceptions of current fish and wildlife management. The ensuing interaction between members and comments from the floor were only mildly contentious. But there were strong undercurrents hinting at significant problems. And these could have erupted in a gathering which had greater heterogeneity. That they did not is a credit to all as it allowed for more orderly examination of presentations.

Neil Jennings of Trout Unlimited opened the panel discussion by stating the basic problems of trout management were political and not amenable to civil service managers. He cited as examples the building of dams on important east slope trout streams and the need for a clear statement of legal access to Crown land. Solutions to such issues certainly involve more than biology.

Lorraine Allison representing private ranchers stated she had no intention of being objective, but she then presented a case for ranchers in a most forthright and able manner. Elk and other wildlife live on private land at a cost to the owner. To overcome this cost she proposed rezoning, more control over elk herds, more winter feeding, improved compensation and last but I suspect most important, encouragement for production of wildlife on private land. There is further conflict with ranchers by hunters in trespass and causing vandalism. While only a few "slob" hunters cause these problems, all hunters must accept the responsibility for corrective action.

Ron Gladish spoke on behalf of the 24,000 member Alberta Fish and Game Association. Although his members are knowledgeable and have strong opinions on current management programs, he doubts if the general public knows or cares. This is a perceptive observation that matches the information on public attitudes toward wildlife given by keynote speaker Bob Fields. This must be of grave concern to both the Alberta agency and the Fish and Game Association. I believe an unaware public is an easy mark for emotional T.V. presentations of wildlife issues.

The Alberta Fish and Game Association believes the media give the illusion that little if anything is being done about fish and wildlife problems. This occurs because government does not know how to get credit when it does something right. Mr. Gladish offered elk management in the foothills and the interface with ranchers on allotment areas as examples where good work is not properly recognized. This lack of knowledge leads to decreased public support so vital for innovative management. Some improvement in public image is possible if wildlife scientists could provide concerned person(s) with the results of field work in plain language and in a useful time frame. I sympathize with him but despair for such positive actions.

Metis spokesman Sam Sinclair gave a thought-provoking insight on the rights of aboriginal people - their rights are now

being negotiated at the national level. If successful, the Metis want a land base upon which they can manage all resources. These lands would be mainly in Northern Alberta where 80% of the 100,000 metis live. All rents, licence fees and other income for use of the land and resources would accrue to the Metis to be used in carrying out management. They would probably employ biologists to work on ventures such as game ranching. Sam Sinclair spoke effectively in a low key and humorous manner, but the implications of his views affect all forms of resource use.

Vivian Pharis represented the Alberta Wilderness Association. Overall, this group supports the Fish and Wildlife Division on most programs and, in particular, approve of the goals and objective statements. They are concerned about lack of access to some wilderness areas, shortage of field officers and the decreased budget support for research. All of these are interpreted as a lowered government priority for fish and wildlife when compared to forestry and agriculture, even though comparative economic values are similar. As an individual she was willing to pay more to hunt elk if the funds were used to solve the livestock/elk conflict.

Gerald Labrie of the Alberta Trappers Association was upset by the amount of wildlife habitat being lost to forestry, grazing areas and industrial developments. Much of the land being taken up for agriculture is marginal for that purpose and should be kept by the Crown for wildlife and other compatible uses. Along with loss of habitat, the logged areas have increased access, and competition for wildlife results. The trappers want to know how the government makes decisions favouring one resource over another--a serious concern of many issue groups.

The three agency representatives, Tom Mill, Ken Ambrock and Bill Hall did not offer solutions to the issues raised by the other panelists. The reason of course is that such issues are mainly socio-political in content and not amenable to biological redress. But they did reassure the symposium that action was taken when they had freedom and authority to act.

Perhaps a quick look at the issues brought out by the panel will shed some light on why the agency could not be more effective.

1. Clear-cut legal access required to Crown Land.
2. Native land claims could substantially alter agency management responsibilities.
3. Concerned elements of the public want better information on which to base their judgement of fish and wildlife programs.
4. The level of decision making by co-operators or co-managers is not clearly established. "Who is the master and who is the servant?" requires a clear legal statement.
5. If wildlife production is encouraged on private land how will the payment be made?

On a technical basis it appears to me that the agency can be quite effective as advisors or even first level managers. But when solutions involve broader issues such as priority of land use and allocation of fish and wildlife as well as the issues previously listed, I doubt any biologist or the agency can be effective on a unilateral basis. This supports Neil Jennings' belief.

The two concurrent workshops on Day II dealt with fisheries and wildlife management techniques. Speakers were to address three aspects of management.

1. Techniques presently available to reach stated objectives.
2. Techniques currently used in Alberta.
3. Techniques which might apply in future in Alberta.

The wildlife session under S.E. Stephanson treated these queries in two ways. First, the extensive kind of management was documented by Bill Hall and Bill Wishart in their papers on census and harvest evaluation. These are agency responsibilities required for stock management. Second, intensive management was described by papers on habitat evaluation, land reclamation and a specific type of winter feeding currently being used in Manitoba.

The agency papers on census and harvest analysis were elementary, but clearly stated basic techniques and analysis required to manage many species throughout a large province containing many habitat types. Hall and Wishart stressed the kinds of data necessary for good management decisions. In my experience the details of sophisticated tehniques such as radio tracking or model building capture the public's (and often senior administrator's) attention to the detriment of the results being used as planned. The two papers kept it simple and practical. (Always the best when managing a diverse group of species throughout a large province). The future use of technology was only mentioned as a way to gather required information for stock management. While I agree with this philosophy some notion of newer techniques would have helped to stretch our minds.

Jeff Green and Herb Goulden explored the intensive side of wildlife management. Mr. Green's paper was a cook book for reclaiming wildlife habitat disturbed by development. The techniques are costly, but as he pointed out, if part of early planning, the required fact gathering and implementation costs can be reasonable. He stressed the use of early seral native plant communities to attract pioneer wildlife species and then allow natural succession to proceed. Otherwise the costs to maintain a site in an early seral stage could be prohibitive. His examples were taken from experience with industrial developments. It would have been useful to have some idea of costs to assist agencies in selecting appropriate projects.

The paper covered many elements of physical landscaping but there was little mention of how to predict species use, or the need to monitor areas over a 5-10-15 year assessment. This is required, otherwise correction and new approaches based on field experience will be lacking. This approach is a natural for involving local people and the author perhaps missed a point in not emphasizing this aspect of the plan.

Herb Goulden described a technique used in Manitoba to decrease agriculture/wildlife conflicts. At least it started out to do this but in practise the technique became much more useful. Through field testing, they found that pelletted deer food would attract deer away from farmer's hay stacks. Using feeding sites on relatively small but strategically located parcels of Crown land, deer damage can be reduced, deer survival increased and strong public support gained through hands-on involvement. Even without the real benefit of an improved public image, the program is cost effective. It is a technical innovation that can turn a negative problem into a positive situation. The side effcts of bringing wildlife management one step closer to intensive animal husbandry and projecting a strong image of sportsman caring for animals may be more important than the benefit to the deer. Intensive management and involvement of local people go hand in hand but to date agencies have been slow to offer inducements to encourage such programs. Manitoba has taken a long step into the future by this action.

The fisheries technical session was organized by E. Stenton who gave an excellent overview of contemporary management in Alberta. The vital signs for fisheries are

1. Anglers increasing 5% per year.
2. Alberta hs a relatively small amount of fish habitat.
3. High demand for fish.

These indicate a seller's market. Mr. Stenton stated most if not all of the easy projects have been done and only the difficult and near-impossible remain. The session papers confirmed this as they were prescriptive and specific. This differs from wildlife where the opportunity still exists for extensive management although this will decrease over time.

The role of hatcheries in the future fisheries program was well presented by Mel Kraft. The fish fulture system is guided by the fisheries objectives which state the first priority goes to native, self-producing stocks to be used in the widest variety of ways by residents. Approximately 2/3 of the fishery comes under

this priority. The question raised by Mel Kraft was "What to do with the growing demand for fishing?" He listed ten management options most of which are intensive in scope.

Fish culture is about as close to a factory production line as fish and wildlife agencies can come and as such there appears to be an endless number of technical options such as genetic engineering, hormone treated brood stock, new hatchery husbandry etc. to produce fish on a prescriptive basis as solutions to problems and opportunities. It was suggested that some elements of the hatchery function may be contracted out. I find this to be another facet of the transfer of fish and wildlife to the private sector. It can be beneficial; for example it could result in more rigorous cost/benefit analysis of the end product, fishing satisfaction or it could be detrimental if no competition exists.

I view the proposed future of fish culture with some skepticism. But as long as wild stocks are maintained wherever possible and anglers are willing to pay the true price of stocking, then technology will do the rest. It's called supply and demand and it has been effective.

I was enthralled by Brian Bietz's paper on in-stream flow evaluation. Perhaps because I have always been slightly in awe (or envious) of the hydraulic engineer and his models. Dr. Bietz removed much of the mystique of in-stream flow evaluation and in a simple manner integrated engineerig and biology. His message was clear. Either learn the language of hydrology to negotiate on behalf of the fish resource, or lose out.

The I.F.N. approach as described involves about 20 methods falling into three groups which provide for fish production to be expressed in terms used by water engineers. This provides fisheries managers with defensable and understood figures for inter-discipline negotiations on mitigation or compensation. This was an excellent paper.

Lorne Fitch and J.H. Allan gave complementary papers on improving stream habitat. Fitch emphasized in-stream improvements

of a holistic nature, treating each stream as a specific water and preserving the natural characteristics. He catalogued in-stream improvement devices such as flow deflectors, bank cover, weirs and in-stream cover. But these physical modifications must be used with the entire stream in mind and most important within the constraints of species biology. Jim Allan dealt with stream reclaimation after damage by various types of resource development. While most examples were of the specific site variety such as stream crossing by pipelines, roads and seismic lines, the problems arising from extensive practices such as grazing and forestry were noted and solutions suggested.

Both speakers emphasized that prevention and reclamation techniques are available to keep east slope trout streams productive. Whether or not these techniques are used depends on factors other than biological.

S.B. Smith reported upon an interesting investigation of the impact of stream fertilization upon trout growth in an east slope stream. While of a preliminary nature, the results give good promise that stream enrichment can benefit both trout growth and increase the invertebrate biomass. The materials added were wheat and a commercial fertilizer but the significance is that the element(s) in short supply can be ascertained and fed into the stream.

In addition to the direct benefit to fish at a rather low cost, the technique provides an opportunity to involve fish and game club members.

The final session of three speakers outlined the roles and responsibilities of the public and industry in the management of fish and wildlife.

Bob Webb categorized in detail the existing process by which developers consider fish and wildlife concerns. This process seems somewhat disoriented as the required steps occur both in sequence and simultaneously. But from the steps involved including mediation, habitat appears to be well looked after, but from

previous papers it seems that such is not always the case. So what goes wrong? Webb offers some clues and also suggestions:

1. Streamline the process by identifying the significant steps so delays are minimal.
2. Allow mitigation to be transferable to adjacent sites where better returns can be expected.
3. Industry should monitor and report on rehabilitation work.
4. Industry should assist funding for enforcement.

Public concern, public image, media's role and the need for the agency to involve concerned citizens were mentioned by many speakers. It remained for Richard Roberts to bring these pieces of public involvement into focus. He reiterated the challenge made repeatedly at the opening session that change is now the constant. And he believes that nowhere is this more prominent than in the way people and their government interact. The two days of discussion have really been about change, new technology, innovative projects and new approaches by government, industry and concerned people. The problem for fish and wildlife agencies is the same as for other resource departments. How to manage change?

In his paper on public involvement in resource management, Richard Roberts described the changes in attitude of business. Technology change, social change, economic change and changes in political strategies are key factors requiring business to rethink its methods. Based on his recent experiences in the N.W.T., Mr. Roberts offered the following advice:

1. Public involvement should not be viewed as "negative or a burdensome attachment" to the review process.
2. It is more than controlled release of facts. It seeks to inform (not brainwash) and to involve (not coerce) the public, agencies and government
3. Technical facts are usually not the key to compromise but rather social and cultural factors.

4. The agency (government) should make the initial offer to negotiate the proposed change with the affected citizens.

Public involvement sooner or later runs into the issue: Who makes the decisions? If concerned people are invited to participate they soon want part of the decision making. But agencies and governments are either loathe to do this or believe their legislative mandate requires them to make decisions. Certainly this is true but when the process is started early for a given development or program, information is available and if the public's ideas are carefully considered, then the final result will more likely to be supported, independent of who legitimizes the decision.

Mr. Roberts reviewed one model. Integrated Resource Management Planning, used in S.W. Alberta with good results in overcoming rancher/community conflicts. It did so by bringing the representatives of all sides to the table to work openly for a solution rather than each faction reacting from the outside. It is a good approach and used frequently in S.E. British Columbia.

This paper brought unity or at least offered a solution to many of the issues which were brought up either overtly or covertly. It recommends a process and attitude by which technical, social and economic factors can be rationalized to benefit fish and wildlife.

The first two papers of the final session described working with the government system and establishing effective communications with concerned groups as integral parts of resource development. The final paper documented one company's successful use of these approaches.

David L. Bowman of Canadian Hunter detailed his company's approach in exploring the Alberta Deep Basin for which they received the prestigous Big Horn Award for 1984. Most of the presentation deals with the patient and thorough way they carried out the field investigations. Emphasis was given to early meetings, early planning and frequent contacts for the purpose of informing people

and redirecting effort when required.

Canadian Hunter adopted a business philosophy and strategy of co-operation and acknowledgement of environmental responsibilities. As a result, the extensive field program lasting several years proceeded without major delay, and with minimal environmental impact. It was costly but I suspect a very reasonable price to pay when compared to the staggering costs of delayed projects reported by Richard Roberts.

Canadian Hunter was able to establish and maintain a co-operative and professional relationship with land owners and agencies, and still meet their bottom line of "profitable completion". The need for flexibility to adjust based on field information is equally necessary for both company and agencies. The results speak for themselves.

The luncheon speaker Allan Herscovici described yet another change in social values pertaining to animal rights. Based on his recent book "Second Nature", he reviewed the animal rights movement from its beginning in England over 100 years ago. At that time and until about 20 years ago, it was legitimately concerned with inhumane treatment of animals. Since the mid-60's, the movement has incorporated concern for the environment and species extermination. In Herscovici's opinion, these legitimate concerns were being acted upon with reasonable success. However, the animal rights movement has recently shifted to encompass a broader philosophic view of animals - a kind of citizen of the world with the same rights as humans. This is a movement with a different character and different objectives. It is committed to the belief that man should not kill or hurt any animal. To reach this goal, it is methodiocally attacking the least defensible elements of human use of animals. Killing of baby seals, leg-hold traps, trophy hunting and the use of fur as a luxury fabric are the immediate targets. Once these are stopped or are receiving strong public condemnation, Herscovici believes they will then try to prohibit the use of animals in biological experimentations, stop hunting, probably stop

recreational angling and ultimately attack the domestication and human use of animals and their by-products (i.e. the livestock industry). He proposed no solution but rather emphasized that the animal rights movement and especially their impact upon native cultures should be critically examined and discussed.

One month after the symposium my impressions are recalled by phrases such as, new technology, new social values, public involvement and media power. Those thoughts all involve change. The strongest message to me was that the many publics acting for their own interests and profoundly moved by the media, will furnish the direction for future fish and wildlife management. This was evident at the opening session and particularly by the panelists as most issues were non-biological. The corollary is that socio-economic factors will be the key to the future or to put it into plain language, the future of fish and wildlife will be decided by votes and dollars. And in so doing, the role of biologists and agencies will diminish as prime decision-makers, but will be enhanced as hands-on managers who can influence grass roots opinion. And that's where it all begins and ends. So all is not lost - indeed I believe it will be better.

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